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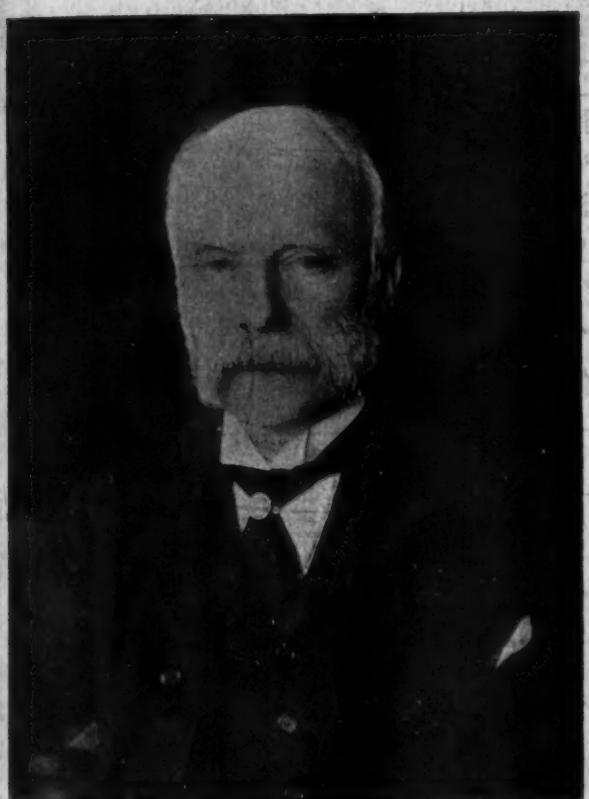
# THE PRACTICAL TEACHER



PROFESSOR A. W. RÜCKER, M.A., LL.D., D.Sc., Sec. R.S.
*President British Association, Glasgow.*

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# THE PRACTICAL TEACHER

A MONTHLY MAGAZINE AND REVIEW FOR THE SCHOOL-ROOM AND THE STUDY

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## BY MANY HANDS.

***"Quot homines, tot sententiæ."***

THE question is not ours, though the thought which prompted it has often passed through our mind. It is a query propounded in *The Academy*, after the perusal of an article on readers in *The New York Critic*. With that greed for personal detail which is so characteristic of the public temper nowadays, people are oftener interested in the question, "*What* do people read?" than in the much more serious one which heads this paragraph.

***Do Readers read?***

The New York writer found that in borrowing books which are published in more than one volume, the tendency is for the second volume to be taken out less than half the number of times that the first volume is borrowed. And should the work run to three or more tomes, the number of times the later volumes are borrowed forms a sequence that diminishes with horrible rapidity. There is, of course, only one inference to be drawn from this—namely, that works in more than one volume are seldom read right through. And of those which are issued in single volume form, no statistics drawn from lending library records can ever tell us whether they are really read through when taken out.

Our own personal opinion is, that in spite of the enormous output of books, and the cheapness of literature generally, there is less *real* reading than when literature was scarcer and dearer.

* * *

ALL sorts of reasons might be adduced, but we think that two causes are more potent than all the others. We mean the growth of the newspaper habit, and the prevalence of what, for want of a better term, we must call "snippet" literature. The newspaper has now become a necessary article of daily consumption, even to the poorest among us; and the aim of the newspaper is to present topics of general, and especially of personal, interest, in a form that can be readily seized by a roving eye. You have only to glance down the columns of a modern journal to see that the act of reading it has been reduced to the rapid perception of a number of landmarks. The toil of reading carefully through columns of matter has been replaced by the act of gathering in at one swoop a number of boldly-printed hints which convey the daily news, as it were, by suggestion. If you add to this habit the prominent fact that the general public seems greedier and greedier of scraps of personal detail about all and sundry, it is easy to see that the newspaper habit militates strongly against real reading.

***What is to blame?***

* * *

AND among a considerable section of the population "snippets" have had an equally deadly influence. For journals of this class are filled with columns of disjointed scraps, whose only connection is their numerical sequence, and whose sole claim to attention lies in the novelty or monstrosity of the shreds of information they may contain. Now, *real* reading implies the assimilation or apperception of the ideas contained in what we read. But we defy any one to assimilate into his own mind half the ideas contained in, say, a column of scientific, or numerical, or amusing "snippets," simply from the lack of connection. If you doubt this, test your own memory of the epitome of general news or of the "varieties" column of your morning newspaper at the close of the day, and you will be in a position to estimate the permanent result of glancing down or wading through a journal which is filled with nothing but these minute scraps of information. In point of fact, we believe that though we

***Snippets—***


☞ ***To Foreign and Colonial Readers: see page 219.***

go through a vastly larger amount of letterpress than our forefathers did, of real reading we do less. The old saying, "Fear the man of *one* book," is a true one, and the number of volumes with which the average reader has a nodding acquaintance is oftener an indication of his power of "skimming" than a gauge of his reading.

TAKE, for instance, an author like Dickens, of enormous popularity, whom we suppose nearly every one reads at some time or another. How many readers of Dickens—and careful readers, too—could pass Charles Stuart Calverley's examination paper on *Pickwick*? Very few, we are sure. And the same might be said respecting many other authors whom it would be considered "bad form" not to have read. If that is the case with classics and established favourites, what must happen in connection with the piles of light reading poured out every year, to say nothing of the serious works? "Skimmed and forgotten," is their epitaph. Of traces of the result, none. We might as well ask with Villon, "*Où sont les neiges d'antan?*" (Where are the snows of yester year?) Ten minutes' conversation on books with the average man or woman will prove the truth of this, for their memory of their reading is generally a muddle of names, personages, incidents, and arguments, in which nothing is clearly perceived. They have arrived at the mental rag-bag stage as the result of their application.

***And the result.***

"Do readers read?" It is no paradox, but a serious question. Our answer is, Yes, and No! They read much; but "Do readers *read?*"—put in that way—we answer, Very little.

THE growth and development of language is always a fascinating study, and in the case of our own mother-tongue, its invasion by Americanisms gives an added piquancy and *actualité* to the occupation. So, when in a prominent weekly we saw the suggestion that those interested in the study of the development of speech would do well to procure a little book hailing from the States, called *John Henry*, we naturally made haste to secure that interesting individual. "John Henry" is a specimen of young America, of the gilded youth of New York, who talks and writes the very latest form of English as she is spoke on the other side of the Atlantic. Heaven forfend that it should spread to this side! The bare thought sends a shiver through the reader.

***The Coming of John Henry.***

American slang usually has the merit, if merit there be, of being quaint, incisive, and, in a strange way, descriptive. But these seven little chapters in which John Henry describes his doings at the theatre, in a street car, while playing pool or progressive euchre, and other things, need a glossary which should be equally large. For though at times one gets a glimpse at the meaning of this uncouth language, oftener than not one is in a state of complete mystification.

FOR instance, John Henry thus describes his call upon the lady of his affections: "I'm sitting on the sofa, with one mitt lying carelessly on the family album, and the other bunched around a $1.70 cane, when my lady friend floats into the arena. There's a short-arm clinch, a break-away, and we're back in our corners." He takes her to the theatre to see Bernhardt. He "patters away for the pasteboards." Then "my lady friend togs out in her revelry rags, and I'm somewhat of a Big Event myself when we slide into the Gold-Bond building and reach out for ten dollars' worth of amusement, hot off the griddle."

***John Henry's Speech.***

This is plain-sailing to much that follows. Dollars are usually "plunks" to John Henry, and his lady friend is sometimes "Clara Jane," sometimes "the Proposition in Peaches," or "the Extreme Limit," or "the Whole Output."

As neither John Henry nor Clara Jane could understand French—or "Dago," as J. H. prefers to call it—they would have been at a loss had not the irrepressible youth translated (!) freely as the play progressed. His fraud brought its own punishment, and the ingenuous John Henry thus describes his position:—

"It was a hot evening—for me! Before the second act was half through I went off my dip. I was nutty from pit to dome. I had enough bum French in my top-knot to start one of those sit-back-hold-tight *table d'hôte* places, with wine at forty cents. a grab. It was fierce."

THAT is John Henry's style at the theatre. Here is his description of a restaurant: "Anyway, I took my lady friend to a sumptuous soup-house the other evening for dinner. I've just ordered four dollars' worth off the card, and we're sitting there in the hand-painted beanery chatting pleasantly, and waiting for the longshoreman to journey back with the oysters." This is cryptic, but lucidity itself to the following gem: "I had to get gabby and make Clara Jane believe I associated only with Torrid Tamales. And did I? Oh, ask me easy just to tease me!" England is overrun by Americans and Americanisms, but if ever John Henry's speech takes hold on us, we shall need professors of polite speaking from New York to instruct us in its meaning and use. Just at present we should scarcely like to describe our exit from a social function with the directness which is John Henry's charm. "Clara Jane is a wise guyine. She crawled into her wraps, and we left the mob just as all hands were paddling off to the ice-cream trough." There is a nakedness about that which should place J. H. high in the ranks of the realists.

***John Henry at Social Functions.***

OF course, we English, like other nations, coin, beg, borrow, or steal words, when in need of them, and often enough we "purvey" from American sources. But John Henry's vocabulary startles, and we fervently hope its choice specimens are too frail to become acclimatised here. A man is a "guy" or a "dub," dollars are "plunks," and the superlative for everything is "aces." "Dago," for French, is borrowed from sailors' lingo; but what is a "cinch"? And what figure of speech in conversation is represented by a "four-flush call-down"? What are the "short-arm clinch" and the "break-away," which are apparently employed as greetings? And where in a billiard saloon is the "dope"? What is a "shine"? and what on earth does a man do when he "takes his hunch from Rudyard Kipling's style"? We haven't the faintest glimmer of John Henry's meaning here, though we can guess what he did when in a restaurant he "coughed for a couple of throat-teasers"!

***A Selection from John Henry's Gems.***

There are perils by land and by sea, black perils and yellow ones, but for the English tongue we foresee a worse peril than all these—the Yankee peril. Every year it

***Latin Notes and Tests for Matriculation and P.T. Students will appear next month.***

comes insidiously nearer, and here in John Henry's artless prattlings we have its open manifesto.

Well, forewarned is forearmed. Teachers must start a league for the preservation of English in its pristine purity.

* * *

**A Rector in Khaki.**

A TIME of stress always brings out the cranks, and during the last two years they have hatched out in large numbers, the majority, of course, being khaki-coloured. A recent one is a Suffolk rector who attempts "to solve a national problem" in a little pamphlet on "the true martial spirit," which, he assures us, has been "published with the approval of the Lord Bishop of Norwich and of the highest military authorities." After perusing his brochure, we are not quite clear as to the problem the reverend gentleman is trying to solve. He is careful to draw a distinction between the martial and the quarrelsome spirit; but the experience of our near neighbours tends to show that the line which separates the two is an excessively fine one, and one which is apt to disappear very easily. Whatever "the national problem" may be, it is to be solved, according to this booklet, by the introduction of military discipline into elementary schools, which "might well be substituted for some of *the impracticable subjects* now enforced upon scholars and teachers." (The italics are ours.)

* * *

**The Brass-band Prescription.**

WE needn't point out that this statement is a sheer piece of question-begging. However, the writer goes on to divide up his subject sermon-wise into four heads, and informs us that this introduction of military discipline will produce the true martial spirit by inculcating submission to authority, physical training, self-respect, and patriotism. It is difficult to see how you can substitute military *discipline* for, say, arithmetic or drawing; but after a time it dawned on us that what is meant is military drill. At first we imagined the reverend gentleman wished boys to assemble to the call of the bugle, to change from one lesson to another at the double, receive instruction drawn up in hollow squares, or charge upon their arithmetical problems to the roll of a drum.

The whole thing resolves itself into another statement of the common fallacy that patriotism can be induced by marching and countermarching, by regimental exercises with a dummy rifle, by exercises on drum and fife or brazen instrument.

* * *

**True Patriotism.**

FROM the physical side much good is to be derived from organised exercises; but this good comes equally from gymnastics with military drill, just as the moral qualities of steadiness, obedience, and fortitude also follow. But the feeling, the emotion of patriotism, apart from jingoism, is no more to be got from joining in the peregrinations of a village band, or "forming fours" under the eye of a drill-sergeant, than a taste for literature is to be got from reading "penny horribles."

This patriotism is a matter of slow formation by teaching, by reading, by attention directed to the history of our own country and the formation of its institutions, by slow infiltration of all the influences that make one feel one's solidarity with the rest of the nation. In a word, it is a moral formation, no more to be brought about by brass bands and words of command than love or respect is to be enforced by orders. Our reverend mentor must try again. The patriotism that depends on drill, bands, and flag-wagging is difficult to discriminate from jingoism, and our schools are the last place in which to introduce it.

* * *

**Mystery.**

FROM a well-known Belgian contemporary we extract the following mysterious advertisement: "Rentier de Deurne désire faire l'échange de sa fille unique, âgée de 13 ans, contre enfant wallon." Communications are to be addressed to a teacher named in the paragraph. This is mysterious. Does the "rentier" wish to experiment on a Walloon child some novel ideas in education? or does he wish cynically to disinherit his only daughter in favour of the Walloon? And is M. Pauwels Jacques the teacher merely the intermediary in a question of exchanging two children for educational purposes, or is he the owner of a Belgian baby-farm? The advertisement is cryptic. But, as our Flemish friends say, *wie aanhoudt, wint*—that is, the man who sticks to a thing generally gets it. So, if the Rentier of Deurne really desires the walloon baby, he will probably find it.

* * *

**The Persistence of French.**

THE *Manuel Général* has been noting the permanence of the French language in the old colonies of France that have passed into other hands. The case of Canada is very striking, for there French is as vivacious as ever, and not only language, but institutions. Mauritius is another case in point. English is now, after decrees published in 1832, 1841, and 1847, the official language of the island; but French is the vernacular, and there is only a portion of one of the newspapers printed in English. San Domingo shows a similar persistence; but, in spite of the *Manuel*, Louisiana can hardly be used as a striking example. Much that is French remains, in speech and in names of places; but the works of Mr. George W. Cable show that he has done for Louisiana what Nathaniel Hawthorne did for New England: he has fixed the characteristics and speech of a social order that has passed away. An odd contradiction occurs in this matter of spoken French. Strong as is its persistence in a country where it has taken root, estimated broadly over the whole world, French has declined in importance as a universal medium. Instead of the first place, it occupies the third, some say the fourth. It is beaten by English and German, and perhaps by Spanish also.

* * *

**A little American Book.**

A NEAT little book published by George Bell and Sons, called *Character Building: Thought Power*, by Ralph Waldo Trine, may be useful in giving hints for those most difficult of all lessons—moral lessons. The writer, as might be inferred from his name, is an American. And that very name gives a hint of the style of the book, for it follows the quiet, reflective, non-dogmatic moralising of the great American, Ralph Waldo Emerson. Mr. Trine has done no more than trace out to its psychological and physiological conclusions the trite saying that "thought is the parent of action;" but by showing how this is tied up in the

***Next Month:***

**HOW TO MAKE LANTERN SLIDES.**

**Illustrated.**

**By a Practical Teacher.**

law of habit, and how the law of habit explains character, he has given a hint that teachers can use in instruction. Much of this simply-written little book could be used in informal talks—the very best of moral lessons; for there is nothing your average boy dislikes so much as the infliction of a direct and openly moral sermon.

MUCH, very much. Following Shakespeare, we are in the habit of saying, "A rose by any other name would smell as sweet." But would it? Believe us, there's a tremendous amount of importance in a name. We never come across advertisements for missing next-of-kin without feeling that Fortune has defrauded us and spelt our name wrongly. Then see how your expectations, all your anticipatory frames of mind, vary according to the names you hear. Isn't your mental attitude when you are about to be presented to Montmorency Plantagenet de Vere different from the complex of your feelings on hearing the plain appellation John Smith? Imagine all that is implied in Cavendish or Spenser, and contrast with the abysmal obscurity of Jones or Miller, and then ask if you dare, "What's in a name?" For a book or a play, quite apart from intrinsic merits, the one thing needful is a title, fitting yet striking—something that combines all the advantages of an art poster with the haunting fascination that lurks in the well-chosen name of a soap or a pill.

***What's in a Name?***

ONE of the happiest hits we have seen for some time is in the name applied to the series of books that have followed the Celtic Renascence—the Gloom Series. Was ever name more pat? Or this one, for the volumes in which a mythical Elizabeth is the chief character—the Elusive Eliza Series? Such names are all the world in a nutshell. They are a description and a criticism in one word. And just now crops up another title which is the quintessence of appropriateness—"The Red-Hot Library"! You hear the blaring of the well-intentioned but imperfectly-instructed band; you see the uniforms of the men, the poke-bonnets of the women, the wild ascetic faces beneath the red ribbon, "Blood and Fire"—everything is there in that single phrase. For this is the latest issue of the literary department of the Salvation Army. But who needs to be told the source of the books or the quality of their contents? "The Red-Hot Library" speaks for itself.

***Some Telling Names.***

TO us, personal names are like colours. They have a character of their own, which it pleases us to think is often reflected in their possessors. There are flat, neutral-tinted names like Philip, Edward, Henry, and Joseph—drab names with which you can only associate a drab personality. What a difference in Jack, or Fred, or Harry, or Hal! They sting like a whip, and flash red as you say them. You instinctively prepare for shocks from men with these whip-lash names. But a Roland or an Edwin, a Bertie or a Willie—doesn't the very sound suggest a namby-pamby individual, the hero of a melodrama or of a young ladies' novel? These are of a washy-blue colour to us. David and Sam are heavy—dark-tinted; Bob is blunt, and deep-shaded also; but they all three suggest solid, sterling qualities that verge on the stodgy—just like the deep background colours they suggest. The list could be extended indefinitely, for you will observe we have only hinted at a few names of male things. We haven't ventured on the appellations of the weaker sex. The theory, however, applies in just the same way. "What's in a name?" Believe us, everything.

***Coloured Cognomens.***

## THE BELGIAN TEACHERS' CONGRESS.

VARIOUS are the routes by which the traveller can reach Belgium; but after an examination of numerous time-tables, guide-books, and sailing sheets, the English deputation to the Annual Congress of the *Fédération Générale des Instituteurs belges* (consisting of Mr. Ex-President Jackman and myself) decided to journey *viâ* Harwich and Antwerp. The boat train steamed out of Liverpool Street at 8.40 p.m., and in rather less than an hour and a half came to a stop under the electric lights of Parkeston Quay, almost alongside the steamer. Our berths were already secured on the s.s. *Colchester*, which, by the way, did not strike us as being exactly the best of the fine fleet belonging to the G.E.R. Company. Previous experiences had taught us that when travelling it is a good axiom to "eat when you can," and so, almost before we were out of sight of British soil, we descended the spacious staircase, entered the bright and almost gorgeous saloon, and supped right plenteously. A return to the promenade deck revealed a brilliant moon and a sea quite phenomenally smooth. No risk of *mal de mer* under such pleasant conditions, was the burden of our reflections, and so, as Mr. Pepys says, "to bed." One half of the English deputation rose before 5 a.m., and was rewarded by a sight of Flushing, where we took a pilot on board, and where all the shipping was gaily decorated with flags and streamers in honour of the Queen of Holland's natal day. A "bad tide" was our lot right up the noble Schelde; and Antwerp, with its miles of quays and scores of ocean-going steamships, was reached some two hours later than the advertised time. It was more than a little comforting to us to notice that by far the largest number of the vessels moored either in the Schelde or alongside the wharfs floated the British flag.

***En route.***

MY most agreeable *compagnon de voyage* knows his Belgium pretty well, and under his genial ciceroneship I was able to see a few of the sights of two magnificent cities. Time forbade us lingering in Antwerp more than a few hours, but these sufficed for a visit to the Cathedral, where the world-famed pictures of Rubens were (for us) the great attraction. Since my boyhood's days I had yearned for a sight of "The Descent from the Cross," and truly the far-famed masterpiece has not been overpraised. The Church of St. Paul, whose inner court contains a "Mount Calvary"—an artificial mound covered with pieces of slag and rock, garnished with statues of saints, angels, prophets, and patriarchs, and surmounted by a crucifix—we also found time to see.

***Antwerp and Brussels.***

The railway journey from Antwerp to Brussels is not particularly interesting, and fortunately it is not of more than an hour's duration. I had heard and read much of Belgium's capital previously, and anticipated seeing a bright and sparkling city where the ancient and the modern mingle quite delightfully. Disappointment is frequently the result when one expects much; but no one can be disappointed with Brussels. At one turn

we may see some stately structure of the present, like the Bourse or Palace of Justice, and at the next behold the Hotel de Ville, within which (the guide-books tell us) was being celebrated the ball on the eve of the battle of Waterloo, immortalised by Byron in "Childe Harold." The street life of "little Paris" is inexpressibly attractive to the sober denizens of an English town or city, and we should have been glad to linger long in such fine highways as the Boulevard Anspach and the Rue de la Régence. But "business is business," and we were expected at Mons, where the Forty-fourth Congress of the Belgian teachers' organisation was being held.

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MONS, the capital of Hainault, is a pleasant little town of some 25,000 inhabitants. We had wired the time of our arrival, and were greeted at the railway station by M. Rossignol (who was our guest at Yarmouth last Easter), M. Lemoine, and our old friend M. Ketelaar, who, it will be remembered, took the Brighton Conference by storm. We learned that the opening session was already in full swing, and that we had no time to lose if we desired to take part in it. Very hastily we changed our attire, and *en grande tenue*, although it was but three o'clock in the afternoon, walked through the quaint streets of Mons to the Grand' Place, where the Congress was being held. The streets were brightly decorated, and inquiry showed this to be on account of the teachers' visit. The general secretary of the organisation was giving his annual report when we reached the platform; and at its termination, M. Van den Dungen, the thirty years' president of the Fédération, publicly welcomed us in excellent English, displaying a knowledge of our professional and educational affairs which both surprised and delighted us. (We afterwards learned, in conversation, that the parliamentary article in THE PRACTICAL TEACHER was responsible for much of his knowledge.) Speeches were then delivered, at the president's request, by the French and Dutch representatives, and then came the turn of the English visitors.

***Arrival at Mons.***

"La parole est à M. Allen Croft," said the president; and my maiden speech in a foreign tongue is subjoined, for those who are interested in such things.

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M. LE PRÉSIDENT, Mesdames, Messieurs,—Pardonnez-moi si j'essaie de m'adresser à vous dans une langue si différente de celle dont je me sers habituellement, car mon but est seulement de me faire comprendre par le plus grand nombre possible d'entre vous.

***The Vice-President's Speech.***

Mon collègue, M. Jackman (qui a été président de notre organisation), et moi, nous avons l'honneur et le plaisir de vous transmettre les sincères souhaits et les fraternelles salutations des quarante-cinq mille membres de l'Union Nationale des Instituteurs anglais, qui tous sont sincèrement intéressés à la prospérité de votre organisation. Nous avons pleine confiance, nous espérons qu'elle continuera à prospérer, et que vos délibérations, cette semaine, seront de quelque utilité à la grande cause de l'education.

Les buts que se propose d'atteindre l'Union Nationale des Instituteurs anglais sont nombreux et divers. Pendant les trente-et-un ans de son existence, l'association a travaillé avec autant de zèle que d'ardeur à l'amélioration de l'éducation populaire, et en même temps, elle a fait tout ce qui était possible pour relever la position matérielle de ses membres. Aussi loin que je puisse voir, les treize buts de notre Union Nationale sont compris dans le premier article de votre organisation particulière: "La Fédération Générale des Instituteurs belges a pour objet le progrès d'enseignement, et la défense des intérêts tant moraux que matériels de ses membres."

Depuis plusieurs années, nous avons eu le plaisir de recevoir à nos conférences annuelles, plusieurs membres de votre Comité Général. Ils ont été cordialement les bienvenus parmi nous, car nous reconnaissons que la profession d'instituteur est non seulement nationale, mais encore internationale. Aussi, par ceux de ces membres, qui nous ont honorés de leur présence, nous avons appris beaucoup de ce que vous vous efforcez d'accomplir.

Notre ardente espérance est que ces visites mutuelles puissent faire quelque chose pour créer parmi les peuples du monde entier un esprit d'amitié et de réele fraternité. Nous faisons tous nos efforts pour que ces visites puissent regénérer la théorie de la relation du sang dans le fait, et dans la réalité de sentiments mutuels et d'amitié durable.*

L'année prochaine, notre conférence aura lieu dans l'ancienne cité de Bristol. J'aurai l'honneur de présider cette conférence, et au nom de l'Union Nationale des Instituteurs anglais, je donne dès à présent, aux membres de la Fédération Générale des Instituteurs belges, notre plus cordiale invitation.

J'espère que vous viendrez en grand nombre, et je puis vous assurer que nous prendrons toutes les dispositions nécessaires pour vous rendre agréable et confortable le séjour que vous ferez parmi nous.

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AS soon as the opening session was over, the delegates made their way to the gardens of Vauxhall, where a grand display of gymnastics and exercises similar to the English "musical drill" was gone through. Admission to the gardens was by ticket; but when the English visitors drove up, *les concierges* (who had hitherto closely examined every ticket), impressed possibly by *la grande tenue* and the president's badge of Mr. Jackman, threw back the gates, and with an "Entrez, messieurs!" bowed us into the pretty grounds. The children went through their movements with grace and precision, but English children at similar functions would have shown a little more *élan* or dash from time to time. At the close of the proceedings, M. Alderman Leclercq, Président de la Commission du Vauxhall, felicitated and congratulated the gentleman who had organised the display, and, to our mild surprise, presented him with a beautiful bouquet.

***La Fête Scolaire.***

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AT eight o'clock in the evening the numerous delegates were received officially by the Burgomaster, the Chief Minister of Education for the province, and several of the Town Council. The "foreign delegates" were separately presented to the Burgomaster, who said a few kindly words to each. Then he addressed the general assembly, stated that the municipality of Mons honoured itself by its reception of those who were doing so much for public education, alluded briefly to the history of Mons, and concluded with a few pregnant sentences on the present position of the working classes. M. Van

***At the Hotel de Ville.***

[* In reading over the report of the Congress which appears in the organ of the Fédération Générale des Instituteurs belges, we much regret to note the exclusion of this eloquent paragraph.—ED.]

den Dungen, the president, and emphatically the "strong man" of the Fédération, in a few eloquent phrases voiced the teachers' thanks, and showed what were the aims and objects of the organisation. The whole ceremony did not exceed a quarter of an hour; and then from all quarters of the *grande salle* appeared waiters, bearing trays loaded with glasses of champagne. These

THE HOTEL DE VILLE, MONS.

were offered to every one present, and for an hour or two champagne was practically *ad lib.* and gratis! Outside the Hotel de Ville, in the Grand' Place, an excellent band discoursed sweet music; and the opening day's proceedings terminated with a grand display of fireworks, the gift of the hotel, café, and restaurant keepers of the centre of the town.

* * *

OWING to the fact that part of the Belgian teachers speak Flemish and part French, the Congress meets first of all in sections, and afterwards the sections unite for the consideration of the business. This year the monumental task was attempted of formulating completely, clause by clause, a great Education Bill for all grades and ages. Naturally time prevented this being done, although considerable progress was made; and the Congress next year will attempt to finish the task. On the last day, Mr. Jackman made an eloquent speech, of which the conclusion was loudly cheered. Said he: "To education and the teachers we must look to secure the universal brotherhood of man—when liberty, equality, and fraternity shall be the ruling ideals of all mankind; when war shall be no more; and when the greatest forces of nature, the cleverest inventions of science, and the highest skill of man shall be used to render the men, women, and children of this earth happier and healthier, and more contented citizens."

***Business Done.***

* * *

THERE was not a dull moment during the five days the Congress lasted. Bands and concerts were provided several times a day. Monday evening was given up to a theatrical performance in the Salle de la Bourse, where an excellent French company played "La Parisienne" and "Poil de Carotte," and where the delegates were the guests of the Montois teachers. On Tuesday evening the banquet was attended by over two hundred teachers, and there was but *one toast*, given by M. Van den Dungen. It was sufficiently comprehensive, and included the king, the provincial and communal authorities, the teachers' club, the foreign delegates, the ladies, and the press! M. Masson, *Echevin de l'Instruction Publique*, responded. We noticed that there were no ladies at the *table d'honneur*. Wednesday was given up to excursions, and we had the pleasure of visiting the Château de Mariemont, the Charbonnage (coal mine), and the world-renowned Ascenseur (or lift) of La Louvière. This Ascenseur is used to make the connection between two canals, one of which is said to be seventy metres above the other.

***Social Functions.***

A. G.

## NOTES FROM THE NORTH.

SIR HENRY CRAIK, in his recently-issued report on the inspection of higher-class schools, points out that there were inspected last year ninety-three higher schools, of which thirty-two were higher class public schools under the management of School Boards, twenty-five endowed schools, and thirty-six privately-managed schools. To these schools there were allocated grants to the amount of £25,450 under the Minute of April 27, 1899. On the rolls there was a grand total of 18,215 scholars, and it is interesting to note that of that number there were no fewer than 8,452 who were over the age of fourteen. This proportion, while by no means excessive, shows a considerable desire on the part of the parents of Scottish children to extend the years of instruction beyond the minimum required by law. It is gratifying to learn from the report that considerable progress has been made in recent years with regard to secondary education. While maintaining a high standard throughout the schools, the Department has made no attempt to mould them according to a uniform type. It has all along desired that local authorities should feel themselves free to vary the curriculum according to local needs. It has contented itself with occasionally giving suggestions, but these suggestions were not intended to limit the initiative or responsibility of local managers.

***Secondary Education.***

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THE inspectors appointed by the Department for the supervision of secondary education have been asked to direct special attention to the pronunciation of modern languages, and, as a result, the Department is of opinion that many teachers have not yet fully realised how extremely important this side of modern language study is from the educational, no less than from the practical, point of view. Too often it appears to be taken for granted that pupils can learn by more or less haphazard imitation, without an attempt being made to give them systematic instruction in the formation of individual sounds, or definite guidance as to how to deal with combinations of syllables. The problem is no doubt an exceedingly difficult one, especially in regard to French, but the Department does not think it insoluble. Those teachers who have kept themselves most closely in touch with the advances made in other countries have invariably shown the best results. Now that greater facilities are to be given for the scientific study of modern languages in the Scottish universities, the outlook may be regarded as somewhat brighter. It is much to be desired,

***Modern Languages.***

however, says the report, that better provision should be made for enabling those who intend to become teachers to supplement that scientific study by a definite period of residence abroad.

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WHILE progress, on the whole, has been very satisfactory, there are still some points in regard to which improvement could be made. The premises of the higher-class schools, it is observed, do not always compare favourably with those of elementary schools. It is felt that out of the rates there might be a more liberal expenditure in this direction. School Boards hesitate to expend money, from a fear that secondary education is an affair which interests one class only, and not the whole community. This is a matter which can only be altered by improved public opinion. While the Department is of opinion that there can be no greater error than that of unduly multiplying the number of such schools, and thus producing a wasteful overlapping of agencies, it yet hopes that the constituencies will become convinced that adequate provision for higher education is of the most vital importance to every section of the community, and that a wise expenditure in this direction from local resources will be productive of great benefit, and will ultimately prove of the greatest profit to the inhabitants of the districts prepared to face it. There has also been a tendency to dissipate grants on schools whose primary function is elementary rather than secondary education, and which should look for assistance rather to grants under the Code than to the special grant available under the Education and Local Taxation Account Act, 1892. Again—and it is a very important point—inspectors have very often to lament that the pupils are withdrawn at an age too early to benefit fully by the liberal provision made for secondary education. The only remedy for this, of course, lies in the growth of a more enlightened public opinion.

***Points for Improvement.***

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À PROPOS of the Department's regret at the early age at which pupils leave school, the report takes up the cry for the better education of those youths who are entering upon a mercantile career. Comparisons are frequently drawn between the results achieved by secondary schools in Scotland and in Germany, ignoring altogether the difference in conditions that prevail in the two countries. The Scottish lads continue to leave school two or three years earlier than their German contemporaries, and therefore the responsibility rests not upon teachers, but upon parents. The dissatisfaction in Scotland regarding the defective education of apprentices, the Department looks upon as a thoroughly healthy sign. It means that commercial men are more and more realising the supreme importance of a sound mental training. The remedy for the present state of affairs lies in their own hands. The educational machinery of the country can never have a fair chance until merchants in a body set their faces against the practice of putting boys into business at thirteen or fourteen, and until, in their selection of apprentices, they give preference and reasonable encouragement to those who can produce evidence of having profited by their school training. This, rather than the institution of fresh examinations, must be looked for if the country desires that lads should enter business properly equipped for the work of life.

***Commercial Education.***

IN Circular 320 the Scotch Education Department makes some further explanations of the aims of the Continuation Class Code by defining more precisely its field of operations, and offering some suggestions as to the modes in which managers may co-operate with a view to making the Code an effective instrument for furthering technical instruction, which is defined in this connection as instruction which aims at communicating to the pupils knowledge and facilities having a direct bearing upon some special occupation, industrial or commercial. Both by the Day School Code of 1899 and the Minute of August 24, 1900, the Department's aim has been to simplify and consolidate school work by making instruction in science and art, of a kind and amount to be determined by the general aims of the school, an integral part of the general education given to all pupils, rather than to encourage the teaching of a multitude of subjects to special sets of pupils. The Continuation Class Code presupposes that this general education, whether of an elementary or a more advanced character, is ended; that the pupil has definitely left school; that he is either engaged in some employment, or is making special preparation for entering upon it; and that what he desires and needs is instruction dictated by his experience of the requirements of life and of his particular occupation. Though the subject-matter may be the same, the method of instruction will be considerably different from what it is, or ought to be, in schools which aim at giving a general education, whether of the elementary or secondary type. It is also to be a matter of consideration for the Department whether further steps may not be taken to relieve the curriculum of the schools proper, whether elementary or secondary, from elements and subjects which are foreign to their proper purpose. It is about time these further steps were taken, as the curriculum of many of our schools is very much overcrowded.

***Continuation Classes.***

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SINCE the value of the specialised instruction given under the Continuation Class Code will depend in very large measure upon the thoroughness of the previous general education received by the pupils, it is the first duty of School Boards to secure prolonged attendance at the day school, and to see that when the discipline of school does end, it is immediately succeeded by the discipline of regular employment, combined with attendance at appropriate continuation classes. School Boards, by the Education Act of 1901, have powers for this purpose; and when permission to leave the day school between the ages of twelve and fourteen is granted on account of the proved necessitous circumstances of parents, there should be stipulations as to attendance at suitable continuation classes. Thus the Department is showing its zeal for prolonged attendance. To meet the case of those pupils who have left school, and are still lacking in the elements of that general education which would enable them to profit by specialised instruction in any form, the preparatory classes of Division I. are temporarily included in the Continuation Code. The objects of the instruction in the other divisions are—to provide a well-defined course of instruction of practical value to pupils in view of their occupations, and to encourage pupils in the cultivation of habits of endurance and self-mastery in the pursuit of a worthy object. Casual attendance at newly-formed classes of pupils who attend for a short time merely from a desire for novelty and fresh excitement is discounted.

***Duties of School Boards.***

# THE BRITISH ASSOCIATION AT GLASGOW.

## THE PRESIDENT: PROFESSOR A. W. RÜCKER, M.A., LL.D., D.Sc., Sec. R.S.

THE seventy-first meeting of the British Association for the Advancement of Science opened at Glasgow, the city of exhibitions, on Wednesday, September 11, and closed on the following Wednesday with a general meeting of the eleven sections. Of these sections by far the most interesting to practical teachers was that known as Section L, whose business it was, under the guidance of Sir John Gorst, to deal with educational science. It is not our intention in this place to discuss the deliberations of the eleven sections. Our present business is with Professor Arthur William Rücker, M.A., LL.D., D.Sc., Secretary to the Royal Society, to whom is due much of the success with which the Glasgow meeting is justly credited. It was at Clapham Park in 1848 that the wife of Mr. D. H. Rücker gave birth to the boy who has attained to such eminence as a physicist and as

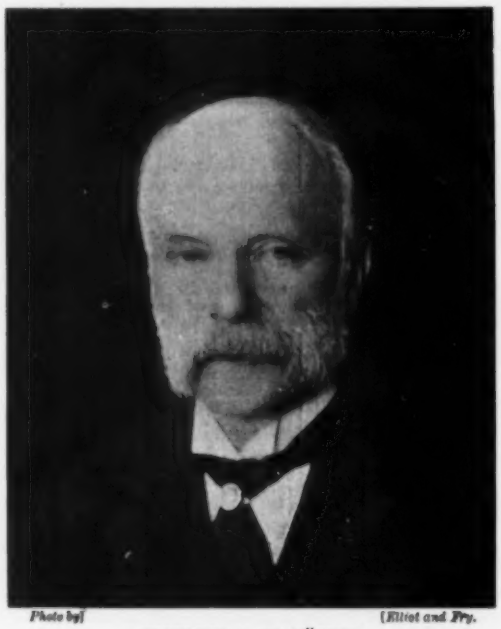

Photo by] [Elliot and Fry.

PROFESSOR A. W. RÜCKER.

a teacher of his subject. The first school attended by Arthur William Rücker was the Clapham Grammar School, whence in 1867 he departed for the University of Oxford, having won an open mathematical scholarship tenable at Brasenose College. So distinguished was his career in mathematics and physics that he became, after graduation, Fellow and Lecturer of his College, and Demonstrator in the Clarendon Laboratory of the University. Upon the opening of Yorkshire College, Leeds, in 1874, the young physicist left Oxford, and became Professor of Physics and Mathematics at the new institution. During the twelve years of his tenure of this office, the professor steadily increased his reputation as a skilled and learned exponent of his subjects. He also aspired, unsuccessfully, to Parliamentary honours, having been the Liberal Unionist candidate for Leeds in 1885, and for the Pudsey division of the West Riding in the following year. It is matter of congratulation that the House of Commons did not absorb the Yorkshire professor, who, upon the death of Professor Guthrie in 1886, was appointed to the vacant chair of Physics at the Royal College of Science, South Kensington. Two years previously, Professor Rücker had won the coveted Fellowship of the Royal Society, the further distinction of a Royal Medal being bestowed upon him in 1891. At the present time he is in possession of the honourable position of Secretary of the Royal Society—a distinction that only the most gifted of English men of science can hope to obtain.

Other societies have also honoured themselves in honouring the South Kensington *savant*. The Physical Society chose him as their President; London University made him a Fellow; and his own college bestowed upon him the title of Honorary Fellow; whilst the newly-formed Victoria University dubbed him Doctor of Science *honoris causa*. As a member of the British Association, Professor Rücker is not new to office, as he has already held the post of Treasurer. But it is within the last few months that the greatest honour of all has fallen upon the President of the British Association. Immediately upon the constitution of London University as a teaching body, it was felt that a man of ripe scholarship and of rare organising ability must be found to act as principal, and to bring into harmony and coherence the heterogeneous collection of institutions admitted to the rank of constituent colleges of the university of the metropolis of the empire. Where was such a man to be found? It is no secret that the eyes of the Senate were turned in the direction of two able men—to wit, the subject of our present sketch, and Dr. Garnett, the admirable Secretary of the London Technical Education Board. The appointment, which carries with it the handsome salary of £2,000 per annum, was offered to and accepted by Professor Rücker, and it is confidently expected that the new principal will lose no time and spare no effort to give that tone of modernity to the university which the Senate practically asked for when they chose the South Kensington professor as first principal of the new teaching University of London.

The contributions of the newly-elected principal to scientific literature are many and varied. In conjunction with Professor Reinold he prepared a series of memoirs on liquid films, that may be found in the *Transactions of the Royal Society* for 1881, 1883, 1886, and 1893.

Together with Professor T. E. Thorpe he carried out the magnetic survey of the United Kingdom, an interesting account of which he gave to the world in the Bakerian Lecture delivered before the Royal Society in 1889, and which may be found in the Transactions for that year. Other subjects upon which Professor Rücker has written are the dynamo, combination tones, and the magnetic properties of rocks. The address which was delivered at Glasgow, and which is still fresh in the minds of our readers, will certainly not detract from the reputation of the accomplished physicist, who will have so much to do with the encouragement of the teaching of science, modern languages, and economics in his new position as Principal of London University.

We may also be permitted to hope that what he heard about education and educational science in Section L will bring him in accord with those who, like ourselves, are of opinion that education, both in science and in general

subjects, would be greatly benefited by the establishment of a Faculty of Education at the Teachers' University, to which burning question of educational politics we invite the attention of Principal Rücker, in the hope that he may deem it as deserving as it is capable of speedy solution.

## THE ATOMIC THEORY.

(*Extracts from Professor Rücker's Presidential Address.*)

OPENING his address with an eloquent reference to that great Queen in whose reign most of the meetings of the British Association had been held, the president came to the subject of his address, which was to discuss some of the hypotheses and assumptions on which the fabric of modern theoretical science had been built, and to inquire whether the foundations had been so "well and truly" laid that they might be trusted to sustain the mighty superstructure being raised upon them.

"The moment was opportune. The three chief conceptions which for many years have dominated physical as distinct from biological science had been the theories of the existence of atoms, of the mechanical nature of heat, and of the existence of the ether. Dalton's atomic theory was first given to the world by a Glasgow professor—Thomas Thomson—in the year 1807.

"It was well known that of late doubts had arisen as to whether the atomic theory—with which the mechanical theory of heat was closely bound up—and the theory of the existence of an ether have not served their purpose, and whether the time has not come to reconsider them.

### The Construction of a Model of Nature.

"The question at issue was whether the hypotheses which were at the base of the most generally accepted scientific theories were to be regarded as accurate descriptions of the constitution of the universe around us, or merely as convenient fictions. He called attention to the word 'convenient.' Even if they were fictions they were not useless. From the practical point of view it was only of secondary importance whether our theories and assumptions were correct, so long as they guided us to results which were in accord with the facts. The whole fabric of scientific theory might be regarded merely as a gigantic 'aid to memory'—as a means of codifying observed facts and laws in accordance with an artificial system, and thus arranging our knowledge under a comparatively small number of heads. The simplification introduced by a scheme which, however imperfect it might be, enabled us to argue from a few first principles, made theories of practical use.....But it was possible that these advantages might be obtained by means of axioms, assumptions, and theories based on very false ideas. A person who thought that a river was really a streak of blue paint might learn as much about its direction from a map as one who knew it as it was. We might be able, similarly, to imagine a working model of inanimate objects, which was nevertheless very unlike the realities of nature. The agreement between the behaviour of the two would probably be imperfect—unless the one was a facsimile of the other—but it was conceivable that the correlation of natural phenomena could be imitated with a large measure of success by means of an imaginary machine which shared with a map or diagram the characteristic that it was in many ways unlike the thing it represented, but might be compared to a model in that the behaviour of the things represented could be predicted from that of the corresponding parts of the machine.

"We might," continued the president, "go a step further. If the laws of the working of the model could be expressed by abstractions —as, for example, by mathematical formulæ—then when the formulæ were obtained the model could be discarded, as probably unlike that which it was made to imitate, as a mere aid in the construction of equations, to be thrown aside when the perfect structure of mathematical symbols was erected.....We should have abandoned the hope of a physical explanation of the properties of inanimate nature, but should have secured a mathematical description of her operations. That was the easiest path to follow—to admit that we could not go below the surface, that we could not know anything about the constitution of material bodies, but must be content with formulating a description of their behaviour by means of 'laws of nature expressed by equations.'" The president went on to observe that "a great school of chemists, building upon the thermodynamics of Willard Gibbs and Van Hoff, were disposed to adopt convenient formulæ without accepting the theory of atoms as necessary or true. But he ventured to assert that the exposition of such a system of tactics was not the last word of science in the struggle for the truth. Whether we grappled with them, or whether we shirked them, the questions still forced themselves upon us: Is matter what it seems to be? Is interplanetary space full or empty? Consequently he should, as far as the present address was concerned, ask whether the effort to form such a mental picture as he had spoken of was legitimate, and whether that picture which science had drawn was to some extent a copy and not a mere diagram of the truth."

### The Analysis and Constitution of Matter.

In dealing with the question of the constitution of matter, and the possibility of representing it accurately, Professor Rücker granted at once that "the ultimate nature of things was, and must remain, unknown. But it did not follow that, immediately below the complexities of the superficial phenomena which affected our senses, there might not be a simpler machinery of the existence of which we could obtain evidence, indirect indeed, but conclusive. A hundred cases proved that it was possible to obtain convincing evidence of the constitution of bodies between whose separate parts we could not directly distinguish, and he took it that a physicist who believed in the reality of atoms thought that he had as good reason for dividing an apparently continuous gas into molecules as he has for dividing the apparently continuous Saturnian rings into satellites. Let them inquire first whether there was valid ground for believing that all matter was made up of discrete parts; and, secondly, whether they could have any knowledge of the constitution or properties which those parts possessed. Matter in bulk appeared to be continuous. Such substances as water or air appeared to the ordinary observer to be perfectly uniform in all their properties and qualities—in all their parts. The hasty conclusion that these bodies were really uniform was, nevertheless, unthinkable. If matter was regarded as a continuous medium, the phenomena of expansion were unintelligible. Combining, then, the phenomena of diffusion, expansion, and heat, it was not too much to say that no hypotheses which made them intelligible had ever been framed other than those which were at the basis of the atomic theory.

"Though science, like Bunyan's hero, had sometimes to pass through the 'Valley of Humiliation,' the spectres which met it there were not really dangerous if they were boldly faced. The fact that mistakes had been made, that theories had been propounded, and for a time accepted, which later investigations had disproved, did not necessarily discredit the method adopted. Without making an insolent claim to be better than our fathers, we might fairly contend that, amid much that was uncertain and temporary, some of the fundamental conceptions, some of the root ideas of science, were so grounded on reason and fact that we could not but regard them as an aspect of the very truth. The existence of ultra-physical entities, and the leading outlines of the atomic theory, were forced upon us at the beginning of our study of Nature, not only by *a priori* considerations, but in the attempt to comprehend the results of even the simplest observation. These outlines could not be effaced by the difficulties which undoubtedly arose in filling up the picture. The cogency of the proof that matter was coarse-grained was in no way affected by the fact that we might have grave doubts as to the nature of the granules. Nay, it was of the first importance to recognise that, though the fundamental assumptions of the atomic theory received overwhelming support from a number of more detailed arguments, they were themselves almost of the nature of axioms, in that the simplest phenomena were unintelligible if they were abandoned."

### The Range of the Atomic Theory.

Professor Rücker, in his defence of the atomic theory, went on to consider its range. The principal mechanical and thermal properties of gases had been explained, and in large part discovered, by its aid. He gave several instances of the wonderful success which had been achieved in the explanation of physical phenomena by the theory they were considering. "They might liken a crowd of molecules to a fog; but while the fog was admitted by everybody to be made up of separate globules of water, the critics of scientific method were sometimes apt to regard the molecules as mere fictions of the imagination. If, however, they could throw the molecules of a highly-rarefied gas into such a state that vapour condensed on them so that each became the centre of a water-drop, till the host of invisible molecules was, as it were, magnified by accretion into a visible mist, surely no stronger proof of their reality could be desired.

### The Limits of Physical Theories.

"It was a mistake to treat physical theories in general, and the atomic theory in particular, as though they were parts of a scheme which had failed if it left anything unexplained, which must be carried on indefinitely on exactly the same principles, whether the ultimate results were or were not repugnant to common sense. Those who belittled the ideas which had of late governed the advance of scientific theory, too often assumed that there was no alternative between the opposing assertions that atoms and the ether were mere figments of the scientific imagination, or that, on the other hand, a mechanical theory of the atoms and of the ether, which was now confessedly imperfect, would, if it could be perfected, give us a full and adequate representation of the underlying realities. For his own part he believed that there was a *via media*. A man peering into a darkened room, and describing what he thought he saw, might be right as to the general outline of the objects discerned, but wrong as to their nature and their precise forms. In his description, fact and fancy might be blended, and it might be difficult to say where the one ended and the other began; but even the fancies would not be worthless if they were based on a fragment of truth, which would prevent the explorer from walking into a looking-glass or stumbling over the furniture. He who saw 'men as trees walking' had at least a perception of the fundamental fact that something was in motion around him. And so at the beginning

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## THE PRESIDENT: PROFESSOR A. W. RÜCKER, M.A., LL.D., D.Sc., Sec. R.S.

THE seventy-first meeting of the British Association for the Advancement of Science opened at Glasgow, the city of exhibitions, on Wednesday, September 11, and closed on the following Wednesday with a general meeting of the eleven sections. Of these sections by far the most interesting to practical teachers was that known as Section L, whose business it was, under the guidance of Sir John Gorst, to deal with educational science. It is not our intention in this place to discuss the deliberations of the eleven sections. Our present business is with Professor Arthur William Rücker, M.A., LL.D., D.Sc., Secretary to the Royal Society, to whom is due much of the success with which the Glasgow meeting is justly credited. It was at Clapham Park in 1848 that the wife of Mr. D. H. Rücker gave birth to the boy who has attained to such eminence as a physicist and as

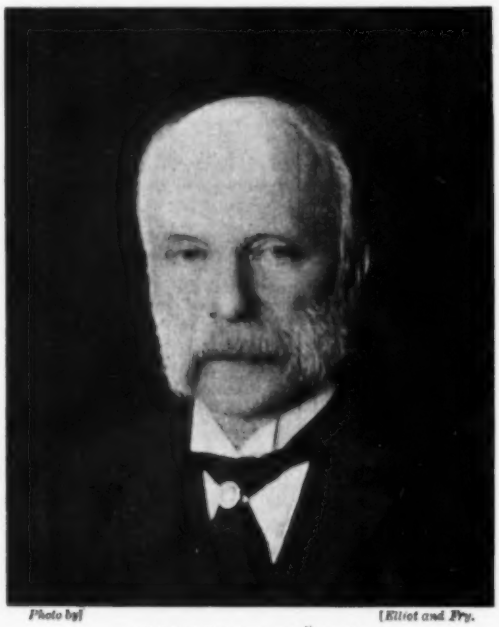

*Photo by]* [*Elliot and Fry.*

PROFESSOR A. W. RÜCKER.

a teacher of his subject. The first school attended by Arthur William Rücker was the Clapham Grammar School, whence in 1867 he departed for the University of Oxford, having won an open mathematical scholarship tenable at Brasenose College. So distinguished was his career in mathematics and physics that he became, after graduation, Fellow and Lecturer of his College, and Demonstrator in the Clarendon Laboratory of the University. Upon the opening of Yorkshire College, Leeds, in 1874, the young physicist left Oxford, and became Professor of Physics and Mathematics at the new institution. During the twelve years of his tenure of this office, the professor steadily increased his reputation as a skilled and learned exponent of his subjects. He also aspired, unsuccessfully, to Parliamentary honours, having been the Liberal Unionist candidate for Leeds in 1885, and for the Pudsey division of the West Riding in the following year. It is matter of congratulation that the House of Commons did not absorb the Yorkshire professor, who, upon the death of Professor Guthrie in 1886, was appointed to the vacant chair of Physics at the Royal College of Science, South Kensington. Two years previously, Professor Rücker had won the coveted Fellowship of the Royal Society, the further distinction of a Royal Medal being bestowed upon him in 1891. At the present time he is in possession of the honourable position of Secretary of the Royal Society—a distinction that only the most gifted of English men of science can hope to obtain.

Other societies have also honoured themselves in honouring the South Kensington *savant*. The Physical Society chose him as their President; London University made him a Fellow; and his own college bestowed upon him the title of Honorary Fellow; whilst the newly-formed Victoria University dubbed him Doctor of Science *honoris causa*. As a member of the British Association, Professor Rücker is not new to office, as he has already held the post of Treasurer. But it is within the last few months that the greatest honour of all has fallen upon the President of the British Association. Immediately upon the constitution of London University as a teaching body, it was felt that a man of ripe scholarship and of rare organising ability must be found to act as principal, and to bring into harmony and coherence the heterogeneous collection of institutions admitted to the rank of constituent colleges of the university of the metropolis of the empire. Where was such a man to be found? It is no secret that the eyes of the Senate were turned in the direction of two able men—to wit, the subject of our present sketch, and Dr. Garnett, the admirable Secretary of the London Technical Education Board. The appointment, which carries with it the handsome salary of £2,000 per annum, was offered to and accepted by Professor Rücker, and it is confidently expected that the new principal will lose no time and spare no effort to give that tone of modernity to the university which the Senate practically asked for when they chose the South Kensington professor as first principal of the new teaching University of London.

The contributions of the newly-elected principal to scientific literature are many and varied. In conjunction with Professor Reinold he prepared a series of memoirs on liquid films, that may be found in the *Transactions of the Royal Society* for 1881, 1883, 1886, and 1893.

Together with Professor T. E. Thorpe he carried out the magnetic survey of the United Kingdom, an interesting account of which he gave to the world in the Bakerian Lecture delivered before the Royal Society in 1889, and which may be found in the Transactions for that year. Other subjects upon which Professor Rücker has written are the dynamo, combination tones, and the magnetic properties of rocks. The address which was delivered at Glasgow, and which is still fresh in the minds of our readers, will certainly not detract from the reputation of the accomplished physicist, who will have so much to do with the encouragement of the teaching of science, modern languages, and economics in his new position as Principal of London University.

We may also be permitted to hope that what he heard about education and educational science in Section L will bring him in accord with those who, like ourselves, are of opinion that education, both in science and in general

subjects, would be greatly benefited by the establishment of a Faculty of Education at the Teachers' University, to which burning question of educational politics we invite the attention of Principal Rücker, in the hope that he may deem it as deserving as it is capable of speedy solution.

## THE ATOMIC THEORY.

(*Extracts from Professor Rücker's Presidential Address.*)

OPENING his address with an eloquent reference to that great Queen in whose reign most of the meetings of the British Association had been held, the president came to the subject of his address, which was to discuss some of the hypotheses and assumptions on which the fabric of modern theoretical science had been built, and to inquire whether the foundations had been so "well and truly" laid that they might be trusted to sustain the mighty superstructure being raised upon them.

"The moment was opportune. The three chief conceptions which for many years have dominated physical as distinct from biological science had been the theories of the existence of atoms, of the mechanical nature of heat, and of the existence of the ether. Dalton's atomic theory was first given to the world by a Glasgow professor—Thomas Thomson—in the year 1807.

"It was well known that of late doubts had arisen as to whether the atomic theory—with which the mechanical theory of heat was closely bound up—and the theory of the existence of an ether have not served their purpose, and whether the time has not come to reconsider them.

### The Construction of a Model of Nature.

"The question at issue was whether the hypotheses which were at the base of the most generally accepted scientific theories were to be regarded as accurate descriptions of the constitution of the universe around us, or merely as convenient fictions. He called attention to the word 'convenient.' Even if they were fictions they were not useless. From the practical point of view it was only of secondary importance whether our theories and assumptions were correct, so long as they guided us to results which were in accord with the facts. The whole fabric of scientific theory might be regarded merely as a gigantic 'aid to memory'—as a means of codifying observed facts and laws in accordance with an artificial system, and thus arranging our knowledge under a comparatively small number of heads. The simplification introduced by a scheme which, however imperfect it might be, enabled us to argue from a few first principles, made theories of practical use.....But it was possible that these advantages might be obtained by means of axioms, assumptions, and theories based on very false ideas. A person who thought that a river was really a streak of blue paint might learn as much about its direction from a map as one who knew it as it was. We might be able, similarly, to imagine a working model of inanimate objects, which was nevertheless very unlike the realities of nature. The agreement between the behaviour of the two would probably be imperfect—unless the one was a facsimile of the other—but it was conceivable that the correlation of natural phenomena could be imitated with a large measure of success by means of an imaginary machine which shared with a map or diagram the characteristic that it was in many ways unlike the thing it represented, but might be compared to a model in that the behaviour of the things represented could be predicted from that of the corresponding parts of the machine.

"We might," continued the president, "go a step further. If the laws of the working of the model could be expressed by abstractions—as, for example, by mathematical formulæ—then when the formulæ were obtained the model could be discarded, as probably unlike that which it was made to imitate, as a mere aid in the construction of equations, to be thrown aside when the perfect structure of mathematical symbols was erected.....We should have abandoned the hope of a physical explanation of the properties of inanimate nature, but should have secured a mathematical description of her operations. That was the easiest path to follow—to admit that we could not go below the surface, that we could not know anything about the constitution of material bodies, but must be content with formulating a description of their behaviour by means of 'laws of nature expressed by equations.'" The president went on to observe that "a great school of chemists, building upon the thermodynamics of Willard Gibbs and Van Hoff, were disposed to adopt convenient formulæ without accepting the theory of atoms as necessary or true. But he ventured to assert that the exposition of such a system of tactics was not the last word of science in the struggle for the truth. Whether we grappled with them, or whether we shirked them, the questions still forced themselves upon us: Is matter what it seems to be? Is interplanetary space full or empty? Consequently he should, as far as the present address was concerned, ask whether the effort to form such a mental picture as he had spoken of was legitimate, and whether that picture which science had drawn was to some extent a copy and not a mere diagram of the truth."

### The Analysis and Constitution of Matter.

In dealing with the question of the constitution of matter, and the possibility of representing it accurately, Professor Rücker granted at once that "the ultimate nature of things was, and must remain, unknown. But it did not follow that, immediately below the complexities of the superficial phenomena which affected our senses, there might not be a simpler machinery of the existence of which we could obtain evidence, indirect indeed, but conclusive. A hundred cases proved that it was possible to obtain convincing evidence of the constitution of bodies between whose separate parts we could not directly distinguish, and he took it that a physicist who believed in the reality of atoms thought that he had as good reason for dividing an apparently continuous gas into molecules as he has for dividing the apparently continuous Saturnian rings into satellites. Let them inquire first whether there was valid ground for believing that all matter was made up of discrete parts; and, secondly, whether they could have any knowledge of the constitution or properties which those parts possessed. Matter in bulk appeared to be continuous. Such substances as water or air appeared to the ordinary observer to be perfectly uniform in all their properties and qualities—in all their parts. The hasty conclusion that these bodies were really uniform was, nevertheless, unthinkable. If matter was regarded as a continuous medium, the phenomena of expansion were unintelligible. Combining, then, the phenomena of diffusion, expansion, and heat, it was not too much to say that no hypotheses which made them intelligible had ever been framed other than those which were at the basis of the atomic theory.

"Though science, like Bunyan's hero, had sometimes to pass through the 'Valley of Humiliation,' the spectres which met it there were not really dangerous if they were boldly faced. The fact that mistakes had been made, that theories had been propounded, and for a time accepted, which later investigations had disproved, did not necessarily discredit the method adopted. Without making an insolent claim to be better than our fathers, we might fairly contend that, amid much that was uncertain and temporary, some of the fundamental conceptions, some of the root ideas of science, were so grounded on reason and fact that we could not but regard them as an aspect of the very truth. The existence of ultra-physical entities, and the leading outlines of the atomic theory, were forced upon us at the beginning of our study of Nature, not only by *a priori* considerations, but in the attempt to comprehend the results of even the simplest observation. These outlines could not be effaced by the difficulties which undoubtedly arose in filling up the picture. The cogency of the proof that matter was coarse-grained was in no way affected by the fact that we might have grave doubts as to the nature of the granules. Nay, it was of the first importance to recognise that, though the fundamental assumptions of the atomic theory received overwhelming support from a number of more detailed arguments, they were themselves almost of the nature of axioms, in that the simplest phenomena were unintelligible if they were abandoned."

### The Range of the Atomic Theory.

Professor Rücker, in his defence of the atomic theory, went on to consider its range. The principal mechanical and thermal properties of gases had been explained, and in large part discovered, by its aid. He gave several instances of the wonderful success which had been achieved in the explanation of physical phenomena by the theory they were considering. "They might liken a crowd of molecules to a fog; but while the fog was admitted by everybody to be made up of separate globules of water, the critics of scientific method were sometimes apt to regard the molecules as mere fictions of the imagination. If, however, they could throw the molecules of a highly-rarefied gas into such a state that vapour condensed on them so that each became the centre of a water-drop, till the host of invisible molecules was, as it were, magnified by accretion into a visible mist, surely no stronger proof of their reality could be desired.

### The Limits of Physical Theories.

"It was a mistake to treat physical theories in general, and the atomic theory in particular, as though they were parts of a scheme which had failed if it left anything unexplained, which must be carried on indefinitely on exactly the same principles, whether the ultimate results were or were not repugnant to common sense. Those who belittled the ideas which had of late governed the advance of scientific theory, too often assumed that there was no alternative between the opposing assertions that atoms and the ether were mere figments of the scientific imagination, or that, on the other hand, a mechanical theory of the atoms and of the ether, which was now confessedly imperfect, would, if it could be perfected, give us a full and adequate representation of the underlying realities. For his own part he believed that there was a *via media*. A man peering into a darkened room, and describing what he thought he saw, might be right as to the general outline of the objects discerned, but wrong as to their nature and their precise forms. In his description, fact and fancy might be blended, and it might be difficult to say where the one ended and the other began; but even the fancies would not be worthless if they were based on a fragment of truth, which would prevent the explorer from walking into a looking-glass or stumbling over the furniture. He who saw 'men as trees walking' had at least a perception of the fundamental fact that something was in motion around him. And so at the beginning

of the twentieth century we were neither forced to abandon the claim to have penetrated below the surface of Nature, nor had we, with all our searching, torn the veil of mystery from the world around us.

"The range of our speculations was limited both in space and time: in space, for we had no right to claim, as was sometimes done, a knowledge of the 'infinite universe;' in time, for the cumulative effects of actions which might pass undetected in the short span of years of which we have knowledge, might, if continued long enough, modify our most profound generalisations. If no other conception of matter was possible than that it consisted of distinct physical units, and no other conception had been formulated which did not blur what were otherwise clear and definite outlines—if it was certain, as it was, that vibrations travelled through space which could not be propagated by matter—the two foundations of physical theory were well and truly laid. It might be granted that we had not yet framed a consistent image either of the nature of the atoms or of the ether in which they existed; but he had tried to show that in spite of the tentative nature of some of our theories, in spite of many outstanding difficulties, the atomic theory unified so many facts, simplified so much that was complicated, that we had a right to insist—at all events till an equally intelligible rival hypothesis was produced—that the main structure of our theory was true; that atoms were not merely helps to puzzled mathematicians, but physical realities."

## OUR SPECIAL CORRESPONDENT'S NOTES.

### Section L—Educational Science.

EVERY annual meeting of the British Association seems to bring with it its own special feature, so that a kind of individuality is attached to its year's proceedings. On this account certain years stand out prominently, associated perhaps with some special discovery, perhaps with some new departure in practical working. Oxford, in 1894, was remarkable for the first announcement of the discovery that the atmosphere contained other gases than the long-known nitrogen and oxygen; Ipswich witnessed the final segregation of the old biological group of natural history subjects with its components; Toronto and Dover marked the cosmopolitan character of science, and the brotherhood of workers of different nationalities. So Glasgow has become identified with the full and formal recognition of the relationship between education and science, and of the fact that the object of the Association—the advancement of science—includes education as well as research. This is brought into prominence by the establishment of a new section—Section L—devoted to the consideration of educational problems, and to the drawing closer together the researcher and those to whom he would communicate the results of his researches.

### Sir J. Gorst's Address.

No better selection of a president could have been made for the new section than Sir John Gorst, both from his position in the Government and his eminence as a theorist upon educational matters. He was admirably supported by an able staff of vice-presidents and secretaries, among the former being Professor H. E. Armstrong, F.R.S., and among the latter Dr. C. W. Kimmins, from the Technical Education Board of the London County Council. Sir John Gorst's presidential address will receive the very careful attention of a large circle of experts, and no doubt many of the views he expressed will be very heartily supported.

### Importance of Character.

At the outset Sir John was careful to deal with a side of the educational problem which is very often lost sight of. Education is not everything, and can by no means be regarded as a panacea for all the ills that beset young life. An even higher aim than that of training the mind is the formation and development of character, and this the schoolmaster is not in so favourable a position to attempt as at first sight seems to be the case. The Vice-President insisted on certain features of the educational problem bearing on this point, emphasising the importance of the character of a people as a whole, and showing that it is more important in the affairs of the world, and a more vital factor in the promotion of national power and influence, and in the spread of empire, than either physical or mental endowments. He went on to point out that the character of each generation depends in the main upon the character of the generation which has preceded it, and that other causes in operation produce a relatively small effect. Improvement and degeneracy are alike slow. The main factor at work in causing either the one or the other must be sought in the homes of the people; while in the cases of those hapless children to whom home is an unmeaning word, the nation is directly responsible for the formation of their character. It is the duty as well as the interest of the nation to provide for the moral education of such children, and to guard others from a contagion which might be spread broadcast by such neglected ones, causing deterioration of character as certainly as a more material form of contagion might spread bodily disease.

### Variety, not Uniformity, of Teaching.

Having thus cleared the ground of a possible misconception as to the possibilities of education, Sir John dealt with many of the practical difficulties that beset the administration of our national system. He touched—perhaps too briefly for many of his audience—upon the question of the age at which school attendance should cease to be compulsory, pointing out that in most countries it is, and must be, determined by economic rather than educational considerations. He emphatically stated, however, that there is no worse mistake than to attempt by too early pressure to cure the evil of too early emancipation from school. During the years of school attendance, variety and not uniformity of teaching should be the rule, and it is greatly to be deplored that the various methods by which children's minds and bodies can be encouraged to grow are still imperfectly understood by many of those who direct or impart public instruction.

### Intelligence Developed by Research.

Upon the vexed question, ever recurring, of the relations between examiners and teachers, Sir John had many things to say. Examinations he holds to be still regarded too often as the best instruments for promoting mental progress, and he considers that a large proportion of the children in both elementary and secondary schools are not really educated at all; they are only prepared for examination. The delicately-expanding intellect is crammed with ill-understood and ill-digested facts, because it is the best way of preparing a scholar to undergo an examination test. Learning to be used for gaining marks is stored in the mind by a mechanical effort of memory, and is forgotten as soon as the class list is published. On the other hand, true education develops the faculty of finding out things for oneself—one of the most valuable with which a child can be endowed. Hence the development of the observation and the intelligence by the study of natural history is an object of great importance. If children in village schools spent less of their early youth in learning mechanically to read, write, and cipher, and more in searching hedgerows and ditch-bottoms for flowers, insects, or other natural objects, their intelligence would be developed by active research, and they would then learn better to read, write, and cipher in the end.

### More Time to Science and Modern Languages.

The president of the section next turned his attention to the more intellectual side of teaching, as distinguished from the character-forming one, and proceeded to touch upon the question of the kind of curriculum of most general advantage. He claimed there is great room for improvement in this respect throughout the country. Classics and mathematics have engrossed too large a share of attention. Science, as part of a general liberal education, has been but recently admitted, and is still imperfectly estimated. Too little time is devoted to it as a school subject; its investigations and its results are misunderstood and undervalued. The acquisition of modern languages has been in bygone generations almost entirely neglected. In many schools the time given to this subject is still inadequate, the method of teaching antiquated, the results unsatisfactory. But the recognition of the absolute necessity for such knowledge in literature, in science, and in commerce is already producing a salutary reform.

### Technological Instruction.

Finally, Sir John had a few pregnant words to say upon the subject of technical education. It is in this branch that Great Britain is most behind the rest of the world; and the nation, in its efforts to make up lost ground, has failed to recognise the fact that real technical instruction, of whatever type, cannot possibly be assimilated by a student unless a proper foundation has been laid previously by a thorough grounding of both elementary and secondary instruction. A few elementary lessons in shorthand and book-keeping will not fit the British people to compete with the commercial enterprise of Germany. Such sudden and random attempts to reform our system of technical education are time and money wasted. There are grades and types in technological instruction, and progress can only be slow.

### Practical Mathematics (Professor Perry).

After an address of this kind to open the proceedings of the section, it is not surprising that many attacks upon the present system of teaching have been made, and many schemes of reform have been brought forward. One of the most animated of all the discussions was initiated by Professor Perry, who voiced a some

what widespread feeling of discontent with the study of mathematics as at present followed. He said that in heroic times every traveller was asked an enigma: if he did not answer, he was killed with torments; if he answered, he was declared a demigod, and given to rule over nations. In those times it was thought good to sacrifice myriads of people for the sake of finding one demigod. So now we taught all boys what was called mathematical philosophy, that we might catch in one net the one demigod, the one pure mathematician, and we did our best to ruin all the others. It was nature's way with fishes—10,000 herrings spawned for one survivor, 10,000 salmon eggs for one marketable fish; 10,000 Toms, Dicks, and Harrys mentally destroyed for the sake of producing one man fit to be a mathematical master of a second rate public school, 10,000,000 destroyed for the sake of producing one great mathematician. This was an altogether foolish way of producing the mathematical master also. The impractical character of mathematical teaching caused mathematical men to leave common sense out of all teaching, and it was this want of common sense which made the usual school and polytechnic and university courses in applied science so elaborate. The professor produced in illustration an advertisement, covering the last large page of a daily paper, of all the courses in a certain foreign polytechnic. He went on to say that he thought that men who taught geometry and orthodox mathematics generally were not only destroying what power to think already existed, but were producing a dislike, a hatred for all kinds of computation, and therefore for all scientific study of nature, and were doing incalculable harm. Speaking from the point of view of engineering, in which he was particularly interested, he held that for the boy of brilliant intellect, of whose education mathematics formed a small part, to whom Euclidian reasoning was a logical counsel of perfection, the shortest study of it was altogether good. But the average boy was stupefied in being forced to study things that had no meaning to him whatsoever. Even the fairly clever mathematical man who became a teacher in other subjects was led by his mathematical study to be too apt, in teaching anything, to begin with the abstract philosophy of the new study. In beginning to teach a boy even to play whist, or to swim, or to write or count, or to play billiards, he would philosophise so much, and introduce difficulties so unnecessarily, that the boy would find it practically impossible ever to learn. He never got to know that the proper method of teaching any subject was through some kind of experimental work. He was the sort of man who made children begin to learn a foreign language by its grammar. The professor concluded his attack by denouncing the present method of so-called education all over the world as utterly unscientific, and said he dared not venture to express his feelings as to the effect which might be produced on the whole world by a reform in the teaching of mathematics.

It was not altogether surprising to find, in the course of the discussion, that his pessimistic views are not shared by many of the leading minds in mathematical study and teaching.

### Botany a Living Study (Professor Bower).

The growing uneasiness in the minds of many specialists in education as to the appropriateness of scientific subjects as part of the curriculum in elementary schools found expression in a joint discussion between the new section and Section K (Botany). The point especially under review was the position of botany in such a curriculum, and incidentally the features presented by the teaching of this subject in universities also. The discussion was opened by Professor Bower, who occupies the chair of Botany in the University of Glasgow, and was taken up by many eminent naturalists, as well as by the specialists in general education. Dissatisfaction with present methods was freely expressed by many teachers of great experience, but the reforms suggested were not universally approved. There were three features which were especially commented upon as militating against botany as a subject for the training of the juvenile mind, which may be mentioned in sequence, though all will not agree that the sequence follows the order of their importance. The first is the position of the text-book in teaching. In most schools the text-book, once selected, dominates the study, and it has no greater and no less advantages than any other text-book study. The reformers claimed that the first acquaintance of the pupil should be with plants themselves, and not with what has been written about them. The teacher should put a plant into the hands of the pupil, and teach him how to examine it, what to look for in it, and lead him on to think about its objects in life, and the way its structure enables it to carry these out. Then he should pass to a comparison of plants with one another, and so gradually enlarge his horizon and fit himself to understand properly the information of his text-book. So the study would be a living and not a dead one. The second point was one which by this method would also be corrected. It was the relatively wide range of the subject that was usually attempted in the time of a school term, far too much being taken up for anything to be dealt with with proper thoroughness. This point, however, led on to a third, in many respects the most formidable of all—namely, the relative influence of the examiner and the teacher in the construction of the syllabus of study, and consequently upon the way of dealing with it. It was pointed out that the reason the curriculum in the schools is too long for the time devoted to it is that the schedule set for examination must be dealt with *in extenso*, if not completely, or risk of failure in the examination is courted.

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The course of the discussion confirmed, however, the already widespread opinion that botany, properly taught, is a valuable part of an ordinary school curriculum, inculcating many valuable habits—observation, reflection, inquiry, consideration, and comparison. Emphasis was justly laid upon the importance of so teaching it that these qualities are all called out in their due sequence. It encouraged the hope that the importance of the text-book may be minimised; much in this respect, however, depending on the possibility of so subdividing the classes that each pupil may receive, to a certain extent at least, individual attention.

### Neglect of Geographical Science (Dr. Mill).

The educational note was struck in the geographical section also, though not so loudly. In his presidential address Dr. Mill appealed to the universities to signalise the arrival of a new century by showing some appreciation of what has long been called the disgrace of the neglect of geographical science by these ancient seats of learning, and by making ampler provision for its teaching. He pointed out, with some definiteness, that though the older English universities were always haunted by the "grinning demon of poverty," the generosity of Mr. Carnegie had brought wealth that last year would have been deemed fabulous to those of Scotland, and said that it would be a disgrace to our country if this splendid generosity did not result in the establishment of one or more fully-endowed and completely-equipped chairs of geography.

### General.

The Association has not, however, allowed these educational movements or upheavals to dominate its ordinary work. Among the multiplicity of papers on other subjects that have been brought forward, many of very great interest might be quoted if the limits of space did not forbid. A few may, however, be briefly alluded to. A very striking communication was made by Major Ross, whose work on malaria in the tropics has been so valuable. The contagion of this disease has been shown to be caused by a mosquito. The organism which causes it undergoes part of its development in the blood of the human being, but finishes its life cycle in the body of the insect, the germs finally appearing in its salivary glands. When the mosquito bites any one at this stage of the parasite's development, the germs are transferred to the attacked person's blood, in which they multiply and produce the well-known symptoms of malaria. Curiously enough, the black races are immune to the disease—that is, the organism does not produce its symptoms when present in their blood. The remedies suggested by Major Ross and his co-workers are the destruction of the eggs of the mosquitoes, and the separation of the camps of the black people from the neighbourhood of the whites. Though the disappearance of malaria entirely may be a long way off, it is evident that the plague can be combated, now that so intimate a knowledge of its nature and causes has been secured.

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Mr. Macalister gave a very interesting report on excavations carried out by himself and Dr. Bliss in four cities on the borders of the ancient territory of the Philistines. He described the sites excavated, and gave an account of the character of the buildings and the remains found, which consisted largely of pottery. One of the most curious results of excavations was the scarcity of objects of personal adornment. In the remains belonging to the whole period from pre-Israelite to Jewish, they found only two objects of gold—one a little ring, apparently an earring, and an iron finger-ring, or thumb-ring, with a layer of gold-leaf. Writing made its appearance during this period, being confined entirely to potters' stamps. The remains discovered threw some light on the pre-Exilic religion of Palestine. Jars bearing potters' stamps, some of them showing names like Azariah, Shebaniah, compounded with the name Jahweh, were found side by side with terra-cotta plaques bearing naked goddess figures, or with yet grosser emblems of Phœnician nature-worship.

# TEACHERS AS CIVIL SERVANTS IN FRANCE.

BY J. H. YOXALL, M.P.

I AM often asked questions as to the condition of the primary teachers in France, and as a rule I avoid an answer. I know a good number of them personally, and have visited not a few of their schools. I respect them as individuals and as a class. The reason why I do not care to answer questions as to their condition is that they are civil servants, and as I am known to disapprove of the idea of making British teachers civil servants, it might be thought that my answers were coloured by that dislike. But it may be useful and interesting to quote from competent observers, who are not English teachers prejudiced either one way or the other, a few pictures from the lives of teachers as civil servants in France.

### A Rural School.

Mr. Clifton Johnson is an American who has written a volume entitled, *Along French Byways*. He thus describes a French country school:—"The school I visited was in a fair-sized village in the northern *département* of Oise. I went into the boys' school first. They had a building to themselves, and were in two rooms of different grades, twenty or thirty in each apartment. The rooms were high, well lighted, and in good repair, and the walls were hung with maps and a variety of helps, interspersed with a number of pictures. On shelves and in cabinets were books, objects of interest in natural history, a collection of minerals, and sets of models to illustrate metric weights and measures and geometric shapes. In front of the master's desk was a small organ. The scholars' desks were the rudest part of the educational equipment. They were long and unpainted, with benches to match, each intended for about half a dozen occupants. The worst of it was that the benches were backless, and the desks behind not near enough to furnish any relief. There appeared to be no place for hats reserved in the school building. Such hats as there were had to be hung on chance wall nails, or tucked into niches about the desks.

"The master and his family lived in the school building, and a door opened from the main schoolroom into the family kitchen. A visitor was unusual, and when I came in (into the school) the master's wife and daughter looked through the door from the kitchen to see who the stranger was. I thought the combination of domesticity and education in such close and familiar relations was rather primitive, and I doubted its expediency; yet it was plain that both the master and his assistant in the next room were capable men, that their methods were modern, and that the children were getting a very fair education.

### The Girls' Department.

"The girls' school made the same favourable impression. The rooms were pleasant, and good work was being done, in spite of the fact that the lady principal affirmed to me in an aside that her pupils were 'little devils.' The seats occupied by the smaller scholars were as lacking in comfort as those of the boys; but the larger girls were favoured with benches that had slender back supports.

"School began at eight o'clock in the morning, and ended at four in the afternoon. A two hours' intermission was allowed at noon, and a short recess in each session. There was, of course, a weekly holiday, on Thursday.

"There were, besides the girls' building, a lesser structure in which the very little boys and girls were taught, and a cottage occupied by the women teachers."

### A French Teacher's Own Views.

Monsieur Leon Frapie is a French schoolmaster who has written a book of scenes from a teacher's life, entitled, *The Rural Schoolmistress*. Before translating some of his pages, it must be explained that in France the commune or parish has to provide a school, although the State appoints, removes, and principally pays the teacher; so that the local influences of parish councillor and priest are almost as strong upon the French teacher as is the influence of the rural School Board member or clergyman on the teacher in England. The parallel is made more accurate by the fact that there are nearly 17,000 clerical or voluntary schools in France, the teachers of which are not civil servants; between the clerical teachers and the lay teachers there is disaccord and often bitter enmity.

### The Appointment of Teachers.

It is a mistake to suppose that under the Civil Service system in France every teacher is sure of employ. "There are more demands of employment in a year than posts vacant in twenty years," writes M. Frapie (in 1897). "The order of application counts for nothing; the choice is guided by personal considerations: it is all a struggle between those who solicit the posts, and private interest overrides the public good very often; the best administrator is he who can best put off the 299 applicants out of 300 to whom he has to refuse the one vacant school." The teachers are trained in county colleges, and must, as a rule, be employed in schools of the same county.

"That morning, M. Chardon, chief clerk of an important railway station, calculated that this was the sixteenth time that he had travelled to the Prefecture to beg a place as assistant-mistress for his daughter Louise. For ten months he had haunted the Prefecture, and during that period only three places had been vacated, so that his daughter had been one of 500 applicants who had rested unsatisfied in spite of their certificates and testimonials.

"But this time he meant to succeed. He had been of some help to a senator who wanted to put the son of his doorkeeper into railway employment, and he had given free travelling tickets to some county councillors who had influence; he had stood a good dinner to a clerk in the Prefecture, and a lady friend of his wife had obtained for her an interview with the Prefect's wife. So that, one way or another, the academy inspector had been brought to recognise that Mlle. Louise Chardon was the most meritorious candidate, and ought to be put at the head of the list."

### Her First School.

So Louise Chardon is sent to Chabois. She makes the acquaintance of her classroom, and is struck with "the severity, the sadness of the place, aggravated by the age of the yellow maps and diagrams of weights and measures." The furniture is poor, dirty, and ignoble. The head-mistress takes her to shop for her dinner, and tells her: "Those two peasants just past are parish councillors; you had better avoid them, and also the mayor and his deputy. You will get no help from the council; they are all uneducated: they know it, and they take a revenge on us. Wait a moment. I must go in here to

ask after a girl with scarlatina. It is the custom; you must always call on every child who is absent. When a girl is away from school, you must be as unquiet about it as a hen that has lost a chick; the health of your pupils is supposed to interest you keenly, and you must not mind the risk of contagion."

### The Primary Inspector.

"Oh, here comes Monsieur the Inspector," the headmistress said. "The inspector is for us what a colonel is to his soldiers: everything that is done with us is 'on the proposition or on the report of the primary inspector.' He only sees us, hears us, knows us: we cannot go over his head; we must address ourselves and our wants first to him."

There are three portraits of inspectors in the book. One of them is a good man in every respect; here is the portrait of one of the others:—

"Monsieur Lecoq began as teacher in a very small parish; his education and general value were small as well. But as secretary to the parish council he was able to render some 'shady' services to one of the councillors, and his reward was to be placed at the head of an important school. Ambition awoke in him: he wormed his way up with the help of his protector the councillor, and at last reached the height of inspector of primary schools. He began to be ashamed of his beginnings, and his first act was to send out of the county a young teacher whose parents had known those beginnings and had sold him his first furniture on credit. Aware that he is not fit for his work, he lives in the fear of losing his post, and all he decides on is guided by the wish to prop himself up. If a complaint is made against a teacher, he *never* takes the teacher's part, because the complainants are councillors or parents of scholars. He writes his reports on teachers perfidiously, damns them with faint praise, and lauds them in such a fashion as to provoke in the mind of the superior officers the reflection that he is too charitable, and the teacher must really be a duffer. And if a teacher does not please him at all costs, the teacher is sent to a smaller school, in a distant hamlet."

### Her Second School.

Louise Chardon falls ill, and afterwards, by skilful begging on the part of her father, is sent to be headmistress at Berny. The mothers of Berny dislike lay teachers, and prefer nuns, so that when Louise goes to the only grocer's shop the woman stares at her, and refuses to serve her.

"Nothing for you, my young woman," she says; and to her neighbours, "If I saw the schoolmistress dying of hunger, I wouldn't sell her even a ha'penny worth."

The nuns, when they left the school to which Louise was sent, had carried away certain benches and tables which belonged to them, and seats for a dozen children were consequently missing. Louise applied to the parish council, and the mayor came to investigate. He appeared to think that Louise must have burned the benches and tables to save her own expenses in firewood. He kept on saying,—

"Anyhow, it was all right so long as the nuns were teachers."

"But, sir, they had furniture which is not here now; they must have taken it away."

"Don't accuse people, m'am'selle."

"The children are using my own two chairs," she said, "and they have broken one of them already."

"Better be careful," said the mayor; "you are responsible for accidents to the children. The nuns used to manage all right without bothering the council."

A little later another interview of the kind took place. The mayor entered, and Louise applied for repairs to the schoolroom and the furniture.

"Oh," said he, "the parish can't afford a ha'penny. I don't come for that. I hear that the little Baroche, one of your pupils, has been bitten by another, the little Benoit, in the playground. The doctor has been called in, and father Baroche demands compensation. You are responsible; better pay up now than go to law. Nobody will protect you; you'd better be conciliatory and pay up smiling."

"I don't mind being generous," she said, "but, like the parish, I'm not rich."

"Bah, bah! an unmarried woman always has savings."

Louise opened the table drawer. "Here is my fortune," she said, showing a gold piece and some silver.

"Oh, that's more than is necessary," said the mayor, pocketing the gold; "that will content the Baroches. A teacher's money is not, like other people's, got with the sweat of the brow." Then, "Don't you ever have anything to drink here, m'am'selle?"

"Pardon, Monsieur the Mayor," said Louise, offering him a glass of her quinine wine.

He drank her health, then left her alone in the silence, the gray sadness, the terrible lonely nothingness.

### At a Teachers' Meeting.

French teachers are not permitted to form themselves into a national union, but they may form a county association, so long as they do not make it a platform for reform and a sounding-board for their grievances.

Once a year the primary inspector convokes the teachers to the chief town of the district, to talk pedagogy with them, get their opinion on books, etc. At these meetings grave problems are discussed, such as, "Ought we to teach shorthand?" and, "Is it nice to teach girls how to cut out shirts?"

On this particular occasion the subject of the conference had been indicated by the inspector beforehand; each teacher was to write an essay on it, and the master and mistress who were to read their essays would be selected by lot.

The inspector called on Monsieur X and Madame Y, and the rest of them stuffed their precious essays back into their pockets discontentedly.

After the meeting is over they go to a restaurant to dine together and talk by the way.

"What a pity about poor Madame Latapie! After twenty-three years in a good school to be sent to a hole like Boizafeu! She had to go, of course; we have to go where we are sent. But they tell me she's taken to drinking since she went, she is so cut up about it."

"But at Burtillon it isn't any better. You have four miles to walk to a shop. The schoolhouse is cold and damp; the mistress has got rheumatism badly; the doctor and the medicine can't be got for days. She has had to give up and go into a hospital."

"Have you heard that M. Benoist has got a bronze medal from the Primary School Society?"

"Don't talk about it; he doesn't deserve it. It is a pure farce. He got it because he buys the school books and prizes from the secretary of the society, that's all."

"It would puzzle M. Duclize to buy his books and prizes, then," laughed another. "There are only eight children of school age in his village, and at harvest time

none ever come to school. Correct and conscientious, each morning at half-past eight he calls the roll, he marks them all absent, says to the walls, 'I can't teach when there are no scholars,' and goes off to dig in his garden."

At dessert a leading schoolmaster proposes two collections—one to "bring the smile of champagne into their glasses" at table, the other to build a tombstone to a dead inspector. Another schoolmaster announces a collection for a teacher who, after thirty-eight years of service, has retired on a pension of £20.

### Her Third School.

After three years at Berny, the good inspector promotes Louise to a larger school at Theragny. When she leaves Berny, she has to pay the council there for a worn-out broom and a lost sponge, and "two francs for burning too much coke."

At Theragny Louise is happy till Inspector Lecoq arrives. He questions the children; is astonished to hear them reason and express ideas. "They ought not to discuss things," he says; "it shows a lack of authority on the part of their teacher. And, then, you appear to attach too much importance to moral instruction; writing and arithmetic are much more useful to girls." Inspector Lecoq takes a dislike to Louise Chardon, and a little while afterwards she is summoned to the Prefecture.

### The Civil Servant at the Office.

Louise wandered in the deserted corridor, full of cold and sadness. This building with the bare walls seemed hostile to such as herself. The clerks seemed asleep, the messengers saucy; she could tell what "small potatoes" they thought a teacher to be. She "received the impression that the teaching service was driven along much as men drive a herd of cattle, without thinking much that the driven are living and suffering beings."

She is ushered into the inspector's room, and is told she must quit Theragny and take a smaller school. She dares not discuss the matter; the inspector is all-powerful. He gives her the choice of punishment, between two very poor villages, and tells her to recognise the justice of her degradation and the fairness of his administration. She goes to her fourth school, falls ill, incurs village hatred because her pupils do not shine in the examination for the Leaving Certificate which French parents make so much of, is practically stoned by them, and dies.

### Lay versus Cleric.

In England we cannot realise how bitter is the feeling between parents, pupils, and teachers of the communal schools and those of the schools taught by the "sisters." The *Bulletin* of the teachers Du Nord recently published the words of a sing-song which the children of clerical schools are taught to chant.

> "At the school of the laics
> You get the colics;
> At the school of the nuns
> You get nice buns,"

is a rhymed free translation.

If the teacher of the communal school goes to Mass, he may be refused the sacrament by the priest on the one hand, and be condemned by the State authorities on the other.

### Outside Occupations Tabooed.

All the prefects in France have lately been reminded of the Law of October 30, 1886, which says: "Public schoolmasters and schoolmistresses are prohibited from engaging in any profession, business, or administrative function, or from any employment in the churches. The schoolmaster may, with the permission of the County Board of Education, act as secretary to the Parish Council." Unable to act politically or municipally, to combine effectively, to use their spare time in eking out their salaries, poorly paid, poorly pensioned, insecure in their tenure of office, working amidst virulent theological odium, the position of the teacher as civil servant in France is hardly one for teachers over here to envy at all.

## JENA AND ITS HOLIDAY COURSES.

BY A. E. STYLER,

*Modern Language Instructor at the Technical Institutes of Beckenham, Redhill, and Sutton (Surrey C.C.).*

I.

"BUT there are occasions when the traveller finds himself carried away in the strong torrent of foreign life and thought and enthusiasm. It may be the performance of a sublime national drama, political agitation, or national rejoicing; the death of a great statesman, an impressive religious service, or eloquent oratory. Then his thoughts fly from one people to another, and before his mental view arises the huge throng of earth's nations small and great, each with her own language, life, hopes, fears; then, if he have any human sympathy, he feels an almost uncanny thrill; the overpowering majesty and vastness of humanity, the pathos of human life with its intricate complexity, its manifold activities, striving and wrestling like the winds of Æolus in their cave-prison, all throng in upon him; and the weird feeling of immensity overpowers him as with a mighty concourse of harmonies and dissonances. It is the organ recital, and the solemn music that thrills him is the great Psalm of Life."

In previous articles on foreign holiday courses, I have endeavoured to show how the weary teacher can obtain a complete and bracing change by taking a plunge into foreign life and thought, returning from his novel surroundings to his familiar home-work filled with new strength and hope, even though he may have been working strenuously during the whole holiday.

Following on our editor's account of the Geneva and Lausanne holiday courses last summer, I this year chose Jena, famous as the home of Herbartian pedagogy; and twenty-four hours' travel from London brought me to the interesting town of Weimar—that is, almost to my destination. After a short stay here I went on to Jena, and an interview with Dr. Rein and Frau Dr. Schnetger resulted in my obtaining a comfortable, conveniently-situated lodging, and permission to attend whatever courses or lectures I pleased—a privilege which enabled me to form a comprehensive idea of the whole organisation.

Then followed a few days during which I had nothing to do but adapt myself to my new environment, and renew my acquaintance with sausages and beer and Prost! Jena is a whimsical jumble of university buildings and institutes, mediæval towers and walls, half-rustic streets that bear world-renowned names, and old-fashioned inns with interesting histories. The hills all around rise so bold and bluff from the valley of the Saale that they produce an impression out of all proportion to their height, and afford an endless variety of delightful walks and ever-changing views. During the month, I had many a long tramp about these hills and woods with a clever, well-read teacher from Brunswick. We used to make a *Bierstation* at every village or hilltop we reached, and chatter upon every conceivable subject. Under such pleasant conditions, it is astonishing what a number of kilometres can be covered without fatigue. There is a pecu-

liar charm about Jena which is very difficult to analyse or define: so many great men have loved the old town and called it by endearing names, so many generations of rollicking, revelling, duelling students have left their mark upon it, so many shady nooks whisper the "great and good words" once spoken there.

I wandered about the sleepy, tranquil streets, noting the funny peasant women with their huge baskets strapped upon their backs, the queer little carriages drawn by dogs, the cosy, shady beer-gardens, and the thousand and one trifles that make up the external life of a foreign town. I chatted with obliging hosts and loquacious waiters, showed newly-made acquaintances some views of London, which I had to explain in German (good practice!), and argued the *pros* and *cons* of the Boer War with all sorts and conditions of men, always falling back upon the battles of Jena and Waterloo when hard pressed. Usually I avoid political subjects when conversing with foreigners, but somehow there was no avoiding the Boer War; it was inevitable from the moment a German knew I was English.

### Student Life.

The university half-year was not quite over when I arrived, so that there were ample opportunities of observing the student life for which Jena is so celebrated. The famous room (*Arminenstube*) in the Burgkeller rang nightly with jolly student songs, and the members of the *Burschenschaft*

DR. REIN, JENA UNIVERSITY.

in their red-banded caps and sashes looked so merry that I wondered regretfully why fate had not made me a German student. Before long an amiable young freshman (*Füchslein*) paid me a visit, and gave me numerous details of his university life, the relations of the young *Leibfuchs* to his *Leibbursche*, the various kinds of student associations, *Korps*, *Burschenschaft*, gymnastic, scientific, or choral societies. By the time he had concluded his explanation of the monograms (*Zirkel*), the *Bierzipfel*, the minutiæ of student etiquette and organisation, I ceased to wonder at the well known fact that the average German freshman does not attempt serious intellectual work during his first half-year. I won the respect of the young *Fuchs* by displaying my knowledge of student slang; but when I had called his room the *Bude* and his house-key *Knochen*, he led me still deeper into the mysteries of student life by expounding the hidden significance of the Monkey, the Cat, and the Herring, those mystic beasts so often seen on student post-cards.

Late in the evening, the students marched in procession round the ancient market square, beating time with the lids of their capacious beer-mugs, and singing *Studentenlieder*. Contumelious Philistines marched two and two behind and irreverently joined in the ceremony, being driven off from time to time by showers of beer from the mugs of indignant students. The statue of the Elector Johann Friedrich was also well drenched with beer, but this was a libation (*Bieropfer*) to his memory as the honoured founder of the university. The mediæval buildings standing out black against the moonlight, the queer goose-step, half solemn, half grotesque, the students old and young, beardless youth and ancient graybeard, the red lights and the Philistine spectators, formed a most remarkable scene. And it has a remarkable German name—*Renommierbummel*.

The number of faces which are more or less disfigured by duelling wounds is astounding. My student friend treated me to a lengthy dissertation on these honourable scars (*Schmisse*), dwelling lovingly on the most beautiful pattern of all, a long, straight cut from ear to mouth, for which much-desired adornment there is a special term—*Durchzieher*. This wonderful talk on *Schmisse* reminded me of Darwin's chapter on "The Sense of Beauty."

I had the honour of spending an evening in my friend's *Studentenhaus* on the Bismarckhöhe with a numerous company of Pauliner. We sat round a great table, drinking beer and smoking under the direction of the *Präses*, and in strict accordance with the rites and ceremonies of the marvellously-complicated *Bierkomment*. There were present students of all stages, from the young *Fuchs* to the *alter Herr*, and the prompt obedience of the young freshmen was most touching. The stentorian order of the president, "Fuchs! eine halbe!" never once found them unready. I may as well confess that the allurements of the famous Lichtenhainer beer and the tall wooden mugs with their comical lids proved too strong for me; so that the following day I was almost invalided. But one must be prepared to incur risks in the cause of knowledge. It would have been ridiculous to go to Jena without trying the Lichtenhainer. The Pauliner are a musical set, and four students sang beautiful part-songs from time to time, as a change from the jovial lays of the *Kommersbuch*. I shall always remember with pleasure my merry revel with the Jena students. The cordial speeches, the lively chat, the hearty *Salamander* in honour of visitors from distant universities, the nocturnal walk home down the Forstweg with town and vale and mountain bathed in bright moonlight, the vein of dreamy poetry running through some of the songs, all helped me to understand better that peculiar German word *Gemüt*.

The inaugural meeting in the Burgkeller on Sunday evening (August 4) was also a pleasant experience. Dr. Rein, with his magnificently clear delivery and unfailing tact and courtesy, made an ideal president. He heartily welcomed the visitors of all nations to Jena, *das liebe alte Nest*, and spoke in eloquent terms of the noble task which unites the teachers of various nationalities in one great international brotherhood, and raises them to a serene atmosphere where political strife should not come. He exhorted us to make the most of our opportunities both for earnest work and agreeable recreation, and hoped that friendly intercourse would remove many a national prejudice. Then followed the old custom of mutual introduction: each student arose in turn and announced his or her own name and dwelling-place; after which we were all on a friendly footing together, in spite of unpronounceable names and wide differences of race and language. It was a happy gathering of the nations. We took our song-books and sang the well-known melody *An der Saale hellem Strande*, and drank beer and smoked, and chatted and laughed. It was the jolly *Studentenkommers* of the previous night all over again, with the additional zest peculiar to an international meeting.

### Mental Stimulus.

The next day began my arduous task of trying to hear and see a little of everything. The courses are divided into four sections—(1) Science; (2) Theology; (3) Pedagogy; (4) Language and Literature. I paid most attention to the two latter, as being likely to interest English visitors most. The *clou* of the whole affair is undoubtedly Dr. Rein's admirable course on General Didactics. My experience of lecturers is fairly wide, and after extensive comparison with all the ablest English, French, and German professors I have

ever heard, Dr. Rein stands well to the fore among the very *élite*. To quote an American with whom I spoke, his lectures are wonderful for their "magnetism." For myself, I entered the hall of the *Deutsches Haus* in a coolly critical frame of mind, not specially interested in didactics, but merely bent on stringing a few notes together for THE PRACTICAL TEACHER. But I left the hall in a state of enthusiasm, proud that I was a teacher, in spite of a teacher's many limitations and disabilities, and convinced that a teacher's work is far above all others. This was the effect of Dr. Rein's eloquence upon one who in his bad moments thinks of the teacher as a miserable *prolétaire intellectuel*, or, to quote Paul Bourget's strong expression, an unhappy *forçat bourgeois*.

### Dr. Rein.

Dr. Rein is an almost perfect speaker, and can be followed without effort even by the foreign listener. There is nothing dry or cold in his treatment of the subject. Through it all we feel that hidden glow which kindles in us lofty ideals and noble zeal. Every moment some long vista of thought is opened up. If he speaks of the teacher's duty as the great work of helping on the evolution of the human race, he makes us feel this evolution as a part of the still vaster question of the origin and destiny of mankind, the deep mystery of the Whence? and the Whither? of the individual and of the race. As he spoke, I thought of the old Saxon ealdorman who compared human life to "a sparrow's flight through the hall when you are sitting at meat in winter-tide. The sparrow flies in at one door and tarries for a moment in the light and heat of the hearth-fire, and then flying forth from the other vanishes into the wintry darkness whence it came." And so I sat and listened with rapt attention, a Japanese on my left and an Austrian on my right, and other earnest listeners from many lands all around.

On another occasion Dr. Rein emphasised the importance of commencing with a sound *general* education as a firm foundation, before attempting to build up the superstructure of special training for any one profession. He showed how this general education, being common to all, would tend to national unity and mutual good will between class and class; whereas whatever is professional, whatever pertains to a man's special occupation, has a narrowing tendency, differentiating and severing class from class. This is a good argument to wield in fighting the faddist, who fails to understand that the duty of a teacher is not to train little mechanics, little shopkeepers, little clerks, little farmers—not to prepare the child for any one walk in life, but to lay a sound basis upon which may be built the character of a useful citizen. Then, with a longer school career and a good system of continuation schools, we can differentiate the youth's education by careful training for his special pursuit. But Dr. Rein's lectures were so symmetrically planned, they were such striking examples of the architecture of thought, that to quote stray ideas from them is almost as foolish as to bring home a block of stone as a sample of Cologne Cathedral. Each lecture was summed up in a blackboard outline, and admirably rounded off with a stirring peroration. All English visitors to Jena should attend this course, even if they are not professionally interested in the subject, for the sake of hearing an excellent German speaker.

### A Famous Institution.

And now a word as to the Pädagogisches Seminar, over which Professor Rein presides. This seminary aims at the development of pedagogic science and the theoretical and practical training of teachers, training-college lecturers, and others who wish to widen and deepen their knowledge of the science and art of education. It is connected with the chair of Pedagogy in the University of Jena, and possesses a perfectly untrammelled practising school, where educational experiments can be made freely; so that we have here an institution which serves the same purpose for the pedagogue as the faculty of medicine, with its hospital practice, does for the medical student. The members assemble three times weekly—(1) The Theoretikum, in which pedagogical questions, previously dealt with by the members in written essays, come under discussion; (2) the Praktikum, in which a member gives a carefully-prepared lesson in the practising school in the presence of his colleagues; (3) the Conference, at which the teacher presents a written criticism of his own lesson. This is followed by a debate, which Dr. Rein sums up with a final judgment. The members of the seminary may be, at the same time, students of the university working for their degree. Living in Jena is cheap, and the fees are not high, so that the total cost per half-year may be estimated at from £25 to £40.

Herr Landmann, the head-master of the practising school, gave me an interesting description of the life and work of the "seminarists," many of whom are foreigners, who have to contend with the difficulty of the German language. During my stay in Jena I met an Englishman and an American who were going to spend a year at this institution as disciples of Dr. Rein. It will be seen that this seminary is quite unlike the ordinary German training college (*Lehrerseminar*), at which the students are young people of from seventeen to twenty years of age. Indeed, some colleges have a six years' course, the age of the pupils ranging from fourteen to twenty—that is, they combine the work of *Lehrerseminar* and *Präparandenanstalt*. The Jena seminary is intended for full-fledged teachers, and Herr Landmann's description of their work, particularly the conferences in the Burgkeller, made me envy the lucky men who had been sent by their home authorities to spend a year in Jena.

I have said enough to show the kind of stimulus one obtains from Dr. Rein's lectures, and it is not surprising that students come from the far East and the far West to learn from him. Hearty hand-clapping and graceful homage testified to the great respect all teachers feel for him; and at the end of the course a warm speech of thanks was made, followed by thunders of applause.

*(To be continued.)*

## THE COURSE OF INSTRUCTION IN TRAINING COLLEGES.

IN accordance with the promise made in the recent circular on the subject (Circular 454), the Board of Education has issued a set of "Specimen Courses of Instruction for Training Colleges."

This action is in accordance with the policy of giving greater liberty to teachers which the Board of Education has been pursuing for some years. The authorities of training colleges are now at liberty to draw up their own curriculum, subject to the Board's approval, and to take a great part in the examination of their students. The advisability of allowing teachers to examine their own students has been often called in question. On the one hand, it is urged that if they are interested in the success of their pupils in the examination, either through their credit or through their purse, they have a strong inducement to let their own pupils through the examination too easily; and on the other, it is assumed that if they have no interest in the success of their students at the examination, they miss a powerful stimulus in their work as teachers. We feel, however, that these arguments are more imaginary than real, and they fail to take account of that love for their work as well as of that sense of honour with which the majority of our teachers and lecturers are filled; and although they may be true in some cases, that would be a reason for removing from their posts those who are not qualified to hold them, and not for opposing a system which has many inherent advantages.

The courses suggested are: Specimen Course No. 1 (for men and women); No. 2 (for men and women), but as this course is identical with No. 1 in the first nine sections, but has a more extensive mathematical course, it is probably intended rather for men; No. 3 (specially adapted to an urban college for women), which contains an absurdly small amount of mathematics; and No. 4 (specially adapted to a country or provincial college), in which the science course is more applicable to rural life, but in which the mathematics course is identical with that in No. 1 or No. 2 (not No. 3),

though we confess we are unable to discover any reason for supposing the student in an urban college is capable of doing less mathematics than her sisters in a country college.

Before entering on a detailed discussion of these courses—which, after all, are only suggestions—we feel bound to condemn, in the strongest terms, any suggestions for a course for the training of teachers which does not recognise the fact that teachers receive only a part of their training in the training colleges. No plan can be considered satisfactory which does not regard the pupil-teacher course and the training-college course as parts of one whole. Any attempt to differentiate these two parts should be in the direction of increasing the opportunities for the general education of the teacher in the earlier part, and of specialising in the pedagogical work in the later portion of the training. Our training colleges, in spite of the admirable work done in some of them, are not, as pedagogical institutions, to be compared with the normal schools of the United States. If, then, the division of labour is not arranged on these lines, then the only sensible plan is for the training colleges to take up both the general and technical training of the teacher from that point to which it has been carried by the pupil-teacher centres and other institutions responsible for the training of pupil teachers. If the collective examinations of pupil teachers and the keen competition at the King's Scholarship Examination do not guarantee the assumption that the syllabus in Schedule V., and that for King's Scholarship, have been thoroughly covered, the sooner a radical change is made the better. But it cannot be seriously contended that the great majority of those who enter training colleges have not done their work as pupil teachers.

We are glad to see that reading and recitation are to be associated with the study of literature. The practice of reading aloud is not only a very useful thing in itself, but imparts an added interest to the subjects of literary study. In all four courses the same treatment is recommended for these subjects.

The syllabus set out for drawing in all four courses, although very simple in itself, is one that should prove most useful for teachers. Those who have special artistic talents may take one of the special courses (C), and obtain special credit for it.

The music course seems a very unsatisfactory one. It is simply a repetition of the pupil-teachers' course. Its inclusion is in accordance with the supposition that our teachers receive a training which makes them "good all-round men." This, however, is not brought about simply by thrusting a large number of subjects into the curriculum, unless each of them is made a failing subject. But the teacher who has absolutely no aptitude for music passes the examination without knowing a note of music, and is not allowed to substitute for it a subject in which he might excel. In the music of Course No. 4, beyond the vague requirement, "General rules relating to voice training," which is included in the "theory," no "practical music" whatever is required. Women students following the first or second course seem to be required to take needlework during the two years, but those following the third or fourth may, at the discretion of the college authorities, drop the subject at the end of their first year. This is a very wise provision; and it might be extended to the pupil-teacher course, for the directress of needlework agrees that if a girl has been taught the subject intelligently up to the age of fifteen or sixteen, there is practically nothing fresh to learn; and if a girl pupil teacher does not find sufficient opportunity for keeping her hand in practice when taking the subject with her class and attending to her own garments, then it simply proves the absence of necessity for spending much time over the subject.

Manual instruction comes to be recognised as a part of the training-college course; in the third scheme it is set down for those students who omit needlework in their second year. We refrain from commenting on the inclusion of manual training in the scheme, because we are ignorant of the reasons which have led to it. If the object is to enable the teacher to acquire greater dexterity, a keener sense of accuracy and proportion, and to induce a co-ordination of hand and eye, then we applaud the introduction; but the students who take the course should be on their guard, and remember that their work is not to teach carpenters, etc., their trade, but to do their best for their pupils' general education.

Most training colleges provided a course of physical instruction for their students; now such instruction forms part of the recognised course.

The course on the theory and practice of teaching differs in some important respects from that in the Certificate Syllabus for 1902. The sections on logic, psychology, and ethics have disappeared, unless they may be considered as included under such phrases as "The scientific principles of education" (Scheme III.), and "The aims and methods of teaching, and the elementary principles underlying them" (Scheme IV.). Froebel and Pestalozzi are held up for special attention. In Scheme IV. there are various points to which the students' notice is directed in teaching the several subjects, but it seems a pity to select some and omit others; and the statement in Paragraph 8 of Scheme IV., "The great object of their [that is, the students'] training being to show them.....(c) *that lecturing is not teaching*," seems the height of absurdity. In the old college days no doubt a great deal of what was called *lecturing* was *not teaching;* but does the Board of Education seriously mean to tell the authorities of training colleges that their chief object is to show their students that while they are attending the college lectures they are not being taught? Again, the words seem to imply that teachers should never employ the "lecturing" or "expository" method of teaching, but "educe" from the children facts of history, geography, etc. If the statement is meant for a universal negative, it is untrue, for some lecturing is teaching, and that of a very high order. It is only true to say that "all teaching is not lecturing."

The English courses seem fairly well drawn up, and to suggest the study of representative parts of our literature. We are pleased to see the Bible recognised as a piece of standard English prose. If it is not taken as a ground for controversy or for theories of authorship, but as a study of beautiful words embodying grand thoughts, the Bible is admirably adapted as a subject for literary study, and that without diminishing but rather intensifying its value from the point of view of religion.

The mathematical syllabus set out in the second scheme follows the lines of the practical mathematics course of South Kensington. It is set out at great length, but some sections, as the algebra, have already been covered in the pupil-teacher course. It is a most useful syllabus of work, although it must be conceded that it will require a great deal of time to cover it, as it goes upon lines which are not usually followed in the study of elementary mathematics.

There are courses of elementary science given which have been practically covered by all pupil teachers who take the science paper at their annual examinations, but of course many do not. There are no great differences in the subject-matter of the courses in Schemes I. and II., while the course in Scheme II. is not only included in Scheme III., but is actually reprinted *in extenso*. The course in Scheme IV. is apparently intended for the "Rurals," but surely the inventor of the new "classification of animals—for example, ruminating, burrowing, hibernating, amphibious, fishes," is a very original naturalist.

The twelfth section of the outline course set out in Circular 454 requires a more extended study of one of the Sections 8, 9, 10, or 11, or a language other than English. Suggestions are given for the language section, and authors selected for reading; and if the instruction that "French and German should be taught orally" is carried into effect, the scheme will confer a great blessing on the country.

We cannot help remarking that the "extended course" of mathematics set out in Scheme I. is a far less serious work than the normal course set out in Scheme II., which may be taken as the normal course in Scheme I.

Of the special courses for which the student is to receive a "distinctive mark on the certificate and in the class list," a detailed scheme is set out in (A) Rural Subjects; and in (E) Languages an indication is given of the length and difficulty of works that should be studied.

# JOTTINGS.

### The N.U.T. Code, 1901-2.

THE delay in the issue of the Instructions to H.M. Inspectors has caused Messrs. Yoxall and Organ's Code to be somewhat belated; but at last it is on sale, and, if possible, in even more attractive form than of yore. Everything is, as usual, included, and everything explained. The new scheme of physical instruction, and latest details as to higher elementary schools, are in evidence; and the usual lucid explanations of the regulations make the now familiar red-covered volume a model of what a *vade mecum* should be. Much is expected from two such experts as Messrs. Yoxall and Organ, and more is provided in the way of useful information than even expectation hopes for.

### New Mathematical Works.

Messrs. J. and A. Churchill announce that, in order to reach a larger number of students, their work on Algebra, by G. H. French, M.A., and G. Osborn, M.A., of the Leys School, Cambridge, has just been published in a new form. Two distinct books are now offered—(*a*) *Elementary Algebra to Logarithms*, and (*b*) *First Year's Algebra to Factors*. Each book appears with and without answers. In reviewing the first edition of this excellent work, we were able to commend it to the examination of teachers, the author's part having been done with most careful, conscientious, and painstaking accuracy.

### Pitman's Shorthand Instructor.

This entirely new edition of the standard text-book of Pitman's Shorthand constitutes a most important departure in phonographic instruction books. It embodies a number of thoroughly tested improvements in the system and in the method of presenting it, which are introduced for the first time simultaneously in Great Britain and the United States. The learning of phonography is greatly facilitated by the twentieth century edition, and the student begins to write words and sentences directly he has mastered the first chapter. For the teacher the revision and rearrangement of the rules, etc., will mean far better results with pupils. To the shorthand practitioner the new work is indispensable, because it comprises improvements he can readily adopt with the utmost advantage, and new phrases rendered absolutely necessary by the accession of the King, and by political, legal, theological, scientific, and commercial changes. New engraved shorthand characters have been specially made for this work, of uniform standard size throughout; while a complete alphabetical list of contracted words is one of the new features. A full prospectus of this twentieth century edition is now ready, and may be had on application to Sir Isaac Pitman and Sons, London, E.C.

### Dr. Evelyn Abbott.

Dr. Abbott, Jowett Lecturer in Greek History, and one of the classical tutors at Balliol College, Oxford, died at Malvern on Tuesday, September 3. His career at Oxford was one of much distinction. Shortly after taking his degree, Mr. Abbott was struck by an incurable paralysis of the lower limbs, which resulted in his being a prostrate invalid throughout his life. But in spite of his disablement, he was an active and sympathetic college tutor, as well as an earnest and laborious student. He bade defiance to so terrible a misfortune by much sweetness of disposition and cheerful bravery. He not only endured but triumphed over his bodily condition, took part in the social as well as the educational life of his college, and was wheeled on his couch to lecture-room or dinner-table, equally beloved and admired by pupils and friends for his cheerfulness and endurance. He was the author of several works relating to Greek history and literature, and was also the editor of that invaluable series of biographical works entitled The Heroes of the Nation Series, published by Messrs. G. P. Putnam's Sons, of London and New York.

### Battersea Polytechnic Classes.

An illustrated prospectus (price 1d.; post free, 3d.) of the day and evening schools and classes for the session 1901-2 has just been published. This magnificent polytechnic (of which a fully illustrated and descriptive account appeared in our issue for December 1897) has been built and equipped at a cost of £82,000, and under the able direction of Principal Sidney H. Wells, assisted by a large staff of lecturers and instructors, the work carried on therein consists of evening classes for both sexes in all subjects of technology, pure and applied science, art, commerce, domestic economy, and music. It also provides a technical day school, a science day school for boys and girls, a training school of domestic economy, a domestic economy school for girls, a day school of art, and special day courses in science and technical subjects. During the last session two hundred and fifty evening classes, in more than one hundred different subjects, were attended by over three thousand one hundred individual students, while five hundred and twenty students were in regular attendance at the day schools and classes.

The institute is splendidly fitted with workshops of every description. There are also gymnasia for men and women, reference library, common rooms, etc. The fullest particulars of the classes will be found in the prospectus referred to. Our readers in Central and Southern London will do well to send to the secretary for a copy.

### Art Publications.

Among the new and forthcoming art publications, Messrs. Chapman and Hall, of Henrietta Street, London, W.C., announce a large number specially prepared to meet the needs of students and teachers. The works, which are written by some of the most competent authorities living, deal with Modelling, Progressive Design, Floral Studies in Decorative Design, Perspective for Art Students, Artists, and Draughtsmen, The Human Figure in Motion, Studies in Plant Form, Italian Wall Decorations, Practical Drawing, etc. The firm also announce a new apparatus for the practical teaching of solid geometry, a new series of plaster casts, as well as a new anatomical cast modelled by Professor Lanteri. The fullest particulars may be had upon application to the publishers.

### Gasc's New French Dictionary.

We are pleased to be able to call attention to this widely read and deservedly popular dictionary of the French and English languages, by F. E. Gasc, now issued in cheaper form. As an abridgment of the author's larger volume, it retains, of course, the main features of that work—namely, fullness of important matter, combined with condensation and conciseness, as well as strict accuracy in the renderings. This new and revised edition, which consists of nearly a thousand pages, is well printed in clear type, and strongly bound. Teachers and students in need of a thoroughly reliable and up-to-date dictionary cannot do better than secure a copy of Gasc at 3s. 6d. It is issued by Messrs. George Bell and Sons of Covent Garden, the publishers of "Bell's Illustrated Classics."

### Millenary of Alfred the Great.

Messrs. George Philip and Son have opportunely published a prettily-executed illuminated souvenir of the millenary. It has been specially prepared from authentic documents by competent authorities, and contains on an attractively-printed card coloured illustrations, and notes printed in bold type, of the landmarks in Alfred's life, what Alfred did, as well as the great king's sayings on nobility, religion, justice, etc. The coloured card is sold at 4d., and it may be had in handsomely framed oak, with gilt slip and glazed (22" × 10"), at 2s.

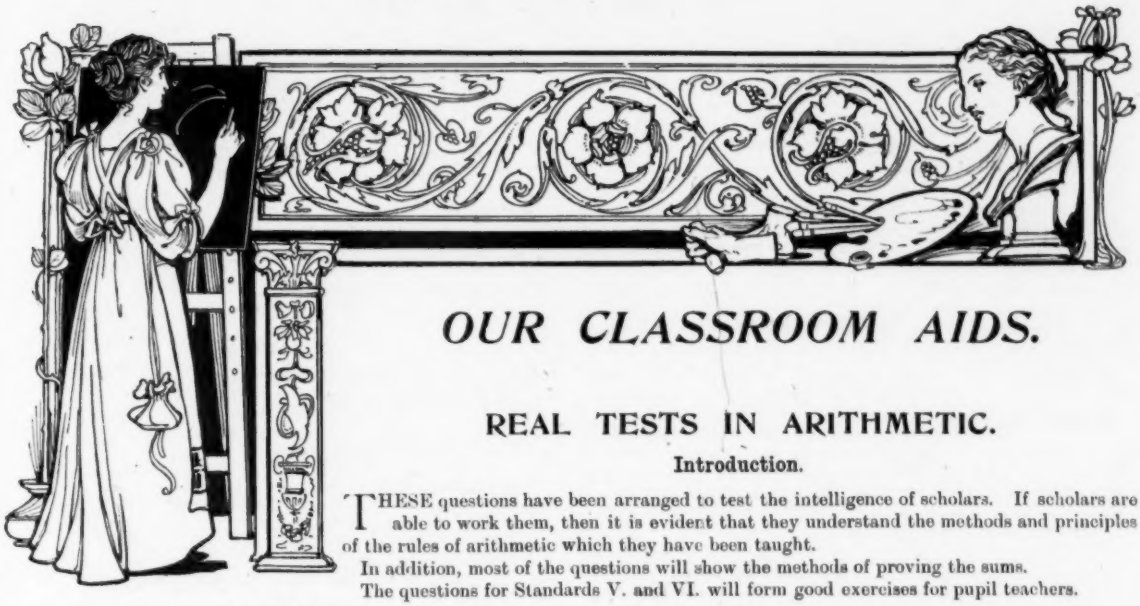
### Modern Languages.

Lord Avebury, in addressing the Association of Chambers of Commerce at the autumnal meeting held in Nottingham, said it was no use sending commercial travellers into a country unless they knew the language; and as long as our schools persisted in neglecting—he might almost say ignoring—modern languages, it would be impossible for mercantile manufacturing houses to find suitable representatives. In the special report on English schools which had recently been issued as a Blue-book by the Education Department, it was shown that in our preparatory schools modern languages and science were almost completely ignored. This was really deplorable. None of them wished classics to be neglected, nor did they desire that special commercial subjects should be taught to boys, but they did wish them to know some foreign language, and something of the world they lived in.

***Next Month:***

**GENERAL GEOMORPHOLOGY.**

**By Dr. A. J. Herbertson, M.A.**



# *OUR CLASSROOM AIDS.*

## REAL TESTS IN ARITHMETIC.

### Introduction.

THESE questions have been arranged to test the intelligence of scholars. If scholars are able to work them, then it is evident that they understand the methods and principles of the rules of arithmetic which they have been taught.

In addition, most of the questions will show the methods of proving the sums.

The questions for Standards V. and VI. will form good exercises for pupil teachers.

### Standard I.

Find the missing lines :—

1.
```
  407
   63
  184
   25
 ....
  987 Sum.
```

2.
```
From 658
Take ...
 394 Difference.
```

3.
```
From ...
Take 576
 287 Difference.
```

### Standard II.

Find the missing lines :—

1.
```
 5789
  306
   92
 ....
   75
  648
 9035 Sum.
```

2.
```
From 36075
Take .....
 7398 Difference.
```

3.
```
From .....
Take 47609
25786 Difference.
```

4. Find the multiplicand :—
```
  ....
     7
 53613 Product.
```

5. Find the dividend :—
```
12 ) .....
 4697 Quotient.
```

6. Find the dividend :—
```
9 ) .....
 7654 Quotient + 8 Remainder.
```

### Standard III.

1. Find the multiplicand :—
```
  ...
   68
 50252 Product.
```

2. Find the multiplier :—
```
   976
  ...
310168 Product.
```

3. Find the dividend :—

Divisor. Dividend.

37 ) .... ( 269 Quotient.

4. Find the dividend :—

Divisor. Dividend.

268 ) ..... ( 345 Quotient.

40 Remainder.

5. Find the divisor :—

Divisor. Dividend.

.. ) 51121 ( 763 Quotient.

6. Find the divisor :—

Divisor. Dividend.

... ) 126283 ( 294 Quotient.

157 Remainder.

7. Find the missing line :—

| £ | s. | d. | |
|---|---|---|---|
| 479 | 13 | 6¾ | |
| 18 | 18 | 10½ | |
| 3064 | 15 | 9¼ | |
| 687 | 14 | 11½ | |
| 23 | 16 | 7¾ | |
| .... | . | . | |
| 6295 | 12 | 8½ | Sum. |

8. Find the missing line :—

| £ | s. | d. | |
|---|---|---|---|
| 786 | 13 | 7½ | |
| ... | . | . | |
| 437 | 15 | 9¾ | Difference. |

9. Find the missing line :—

| £ | s. | d. | |
|---|---|---|---|
| .... | . | . | |
| 5209 | 14 | 3¼ | |
| 2765 | 18 | 10½ | Difference. |

### Standard IV.

1. Find the multiplicand :—

| £ | s. | d. | |
|---|---|---|---|
| .. | . | . | |
| | | 79 | |
| 6919 | 11 | 6½ | Product. |

2. Find the multiplier :—

| £ | s. | d. |
|---|---|---|
| 17 | 17 | 7¾ |
| | · | · |
| 679 | 10 | 6½ Product. |

3. Find the dividend :—

| £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|
| 256 ) ..... | . | . | ( 65 | 18 | 7¾ |

4. Find the dividend :—

| £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|
| 147 ) ..... | . | . | ( 84 | 13 | 9½ |

56 far. Remainder.

5. Find the divisor :—

| £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|
| . . ) 3081 | 11 | 6½ | ( 35 | 16 | 7¾ |

6. Find the divisor :—

| £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|
| . . . ) 22422 | 15 | 8 | ( 64 | 19 | 10½ |

287 far. Remainder.

7. Find the missing number of inches :—
67 yds. 2 ft. · in., reduced to inches = 2446 in.
8. Find the missing number of hundredweight :—
39 tons · cwt. 2 qrs. 25 lbs., reduced to lbs. = 89345 lbs.
9. Find the missing number of quarts :—
358 gals. · qts. 1 pt., reduced to pints = 2869 pts.
10. Find the missing number of minutes :—
27 days 16 hrs. · min. 48 sec., reduced to seconds = 2,392,728 sec.
11. Find the missing figure :—
6 . 3630 oz., reduced to tons, etc. = 18 tons 15 cwt. 3 qrs. 17 lbs. 14 oz.
12. Find the missing figures :—
35 . . 7 in., reduced to yards, etc. = 986 yds. 1 ft. 9 in.
13. Find the missing figure :—
53 . 9 pts., reduced to gallons, etc. = 673 gals. 2 qts. 1 pt.
14. Find the missing figures :—
84 . 9 . 9 sec., reduced to days, etc. = 9 days 19 hrs. 49 min. 59 sec.

## Standard V.

1. Find the number of articles :—
The value of · · · · articles, at £3, 14s. 7½d. each, is found by practice to be £25067, 5s. 4½d.
2. Find the price of each article :—
The value of 4756 articles, at £· , ·s. ·d. each, is found by practice to be £85048, 3s. 7d.
3. Find the quantities :—
The price of · tons · cwt. · qrs. · lbs., at £12, 5s. per ton, is £143, 1s. 3d.
4. Find the price per cwt. :—
The price of 15 cwt. 3 qrs. 19 lbs. 10 oz., at £· , ·s. ·d. per cwt., is £148, 12s. 8½d.
5. Find the length :—
The cost of making a road · miles · fur. · chains long, at £216, 13s. 4d. per mile, was £2131, 9s. 2d.
6. Find the cost per yard :—
The cost of 11 yds. 2 ft. 9 in., at ·s. ·d. per yard, is £6, 14s. 0¾d.
7. Find the quantity :—
The price of · bush. · pks. · gals. · qts., at £1, 2s. 8d. per bush., is £33, 18s. 7d.
8. Find the price per gallon :—
The price of 79 gals. 3 qts. 1 pt., at ·s. ·d. per gal., is £79, 4s. 2¼d.
9. Find the time :—
The rent for · years · weeks, at £12, 7s. per annum, was £65, 6s. 3d.
10. Find the weekly wages :—
The wages for 6 weeks 5 days 6 hrs., at £· , ·s. ·d. per week, was £19, 9s. 8d.
(8 hrs. = 1 day, and 6 days = 1 week.)
11. Complete the bill, finding all the missing items :—

| | | | | |
|---|---|---|---|---|
| 17 | lbs. at ·d. per lb. ..... | £0 | 14 | 10½ |
| · | lbs. at 2½d. per oz. ..... | 0 | 16 | 8 |
| 19 | cwt. at 35s. per ton..... | . | . | . |
| · | stone at 1s. 8d. per stone ..... | 0 | 14 | 2 |
| 13½ | gals. at ·d per pint.. ..... | 1 | 11 | 6 |
| · | yards at 3s. 10d. per yd..... | 2 | 8 | 10½ |
| | | £· | · | · |

12. Complete the bill, finding all the missing items :—

| | | | | |
|---|---|---|---|---|
| 7½ | gross at · d. per doz..... | £1 | 13 | 9 |
| 250 | eggs at · for 1s..... | 0 | 16 | 8 |
| 13 | cheeses, each · lbs., at 10d. per lb.. | 9 | 4 | 2 |
| · | hams, each 27½ lbs., at 9d. per lb... | 9 | 5 | 7½ |
| 85 | oranges at 5 for ·d..... | 0 | 4 | 3 |
| · | ducks at 5s. 6d. per couple..... | 2 | 12 | 3 |
| | | £23 | 16 | 8½ |

13. Find the missing fraction :—
$\frac{5}{8} + \cdot = \frac{13}{24}$.
14. Find the missing fraction :—
$\frac{7}{12} - \cdot = \frac{17}{48}$.
15. Find the missing fraction :—
$\frac{7}{8} - \cdot + \frac{5}{12} = \frac{23}{24}$.

## Standard VI.

1. Find the missing fraction :—
$3\frac{3}{4} \times \cdot = 16\frac{1}{2}$.
2. Find the missing fraction :—
$6\frac{5}{12} \div \cdot = 1\frac{1}{11}$.
3. Find the missing fraction :—
$(\frac{7}{12} + \frac{3}{8} - 1\frac{1}{4}) \times \cdot = \frac{5}{24}$.
4. Find the missing fraction :—
$4\frac{1}{8}$ of $\cdot \div 3\frac{3}{5}$ of $8\frac{3}{4} = \frac{5}{14}$.
5. Find the missing number :—
5·6875 × · = ·38675.
6. Find the missing number :—
·6729 ÷ · = 3·5845383.
7. Find the missing number :—
·8762 + 37·915 − ·
+ 9·80554 = 20.
8. Find the missing number :—
$\frac{\cdot 63}{\cdot} \div \frac{\cdot 05}{\cdot \cdot 41\overline{6}} = 7 \cdot 875$.
9. Find the *fourth* term :—

| Men. | Men. | £ | s. | d. | |
|---|---|---|---|---|---|
| 27 : | 35 = | 1 | 13 | 9 | : Amount. |

10. Find the *third* term :—

| £ | s. | d. | £ | s. | | cwt. | lbs. |
|---|---|---|---|---|---|---|---|
| 1 | 17 | 8 | : 9 | 15 | = Quantity : | 15 | 75. |

11. Find the *second* term :—

| Weeks. | | £ | s. | d. | £ | s. |
|---|---|---|---|---|---|---|
| 25 : | Time = | 6 | 12 | 6 | : 5 | 6. |

12. Find the *first* term :—

| s. | d. | | gals. | qts. | pt. | gals. | qts. |
|---|---|---|---|---|---|---|---|
| Cost : 9 | 11 | = | 17 | 3 | 1 | : 59 | 2. |

## ANSWERS.

### Standard I.

1. 308. 2. 264. 3. 863.

### Standard II.

1. 2125.
2. 28677.
3. 73395.
4. 7659.
5. 56364.
6. 68894.

### Standard III.

1. 739.
2. 318.
3. 9953.
4. 92500.
5. 67.
6. 429.
7. £2020, 12s. 10¾d.
8. £348, 17s. 9¾d.
9. £7975, 13s. 1¾d.

### Standard IV.

1. £87, 11s. 9½d.
2. 38.
3. £16878, 13s. 4d.
4. £12449, 8s. 6½d.
5. 86.
6. 345.
7. 10 inches.
8. 17 cwt.
9. 2 quarts.
10. 38 minutes.
11. 7.
12. 51.
13. 8.
14. 8 and 9.

### Standard V.

1. 6879 articles.
2. £17, 17s. 7¾d.
3. 11 tons 13 cwt. 2 qrs. 8 lbs.
4. £9, 6s. 8d.
5. 9 miles 6 fur. 7 chains.
6. 11s. 3d.
7. 29 bush. 3 pks. 1 gal. 2 qts.
8. 19s. 10d.
9. 5 years 15 weeks.
10. £2, 16s.

☞ **Next month we shall give in this section a complete set of Arithmetic Tests for Standard III. The set will consist of fifty cards, each containing two tests and one problem. Answers will also be published at the same time.**

| | | | | |
|---|---|---|---|---|
| 11. | 17 lbs. at 10½d. per lb. | £0 | 14 | 10½ |
| | 5 lbs. at 2½d. per oz. | 0 | 16 | 8 |
| | 19 cwt. at 35s. per ton. | 1 | 13 | 3 |
| | 8½ stones at 1s. 8d. per stone | 0 | 14 | 2 |
| | 13½ gals. at 3½d. per pint. | 1 | 11 | 6 |
| | 12¾ yards at 3s. 10d. per yard. | 2 | 8 | 10½ |
| | | £7 | 19 | 6 |
| 12. | 7½ gross at 4½d. per doz. | £1 | 13 | 9 |
| | 250 eggs at 15 for 1s. | 0 | 16 | 8 |
| | 13 cheeses, each 17 lbs., at 10d. per lb. | 9 | 4 | 2 |
| | 9 hams, each 27½ lbs., at 9d. per lb. | 9 | 5 | 7½ |
| | 85 oranges at 5 for 3d. | 0 | 4 | 3 |
| | 19 ducks at 5s. 6d. per couple | 2 | 12 | 3 |
| | | £23 | 16 | 8½ |

13. $\frac{1}{4}$. 14. $\frac{3}{10}$. 15. $\frac{3}{5}$.

### Standard VI.

1. $4\frac{3}{5}$.
2. $3\frac{1}{12}$.
3. $1\frac{1}{14}$.
4. $2\frac{8}{11}$.
5. ·068.
6. 5·327.
7. 28·59674.
8. ·6.
9. £2, 3s. 9d.
10. 3 cwt. 3 qrs.
11. 20 weeks.
12. 2s. 11¾d.

# MUSIC AND SINGING IN ELEMENTARY SCHOOLS.

BY AN INSPECTOR OF SCHOOLS.

IT is satisfactory to find that in so many schools singing is taught by note, not by ear only, and it is confidently hoped that each year will see a further diminution of the number of schools in which the scholars are denied the opportunity of acquiring a *power* which assists so much in the elevation of the mind, in the formation of character, and in the provision of wholesome enjoyment. The introduction of the block-grant principle will have achieved a great deal if it only results in music and other subjects being no longer regarded as grant-earning means.

The manufacture of a race of professional musicians is not the object of music teaching in elementary schools. The aims of such teaching should be the training of the ear, by easy stages, to appreciate the distinction between musical and unmusical sounds, to recognise the difference between a melodious and a monotonous succession of sounds, to note the relation of sounds to one another in a musical phrase, and thus enable future generations to derive from music that pleasure which is generally unattainable by an untrained ear. Whilst doing this, the general principles of tone production and of voice culture should be impressed upon the scholars by suitable instruction and training.

The claims of music and singing as a disciplinary aid, and as an agent of refinement and civilisation, have long been recognised; but that good music in schools promotes a sense of co-operation and association, and has a material influence upon reading, recitation, and physical exercises, are points not so generally considered. It must be pointed out, however, that the mere mechanical performance of a number of music tests and exercises does not constitute the musical education which is capable of accomplishing such noble ends.

In order to secure the best results, music teaching must begin early, when the ear and voice are most capable of training; and the lessons should be regular, not spasmodic. The ear and voice require constant practice, hence the advisability of a short lesson of five or ten minutes daily being given. The utilisation for a little voice training of a few minutes at assembly or dismissal, which are not unfrequently wasted, would be very beneficial. It is on the judicious distribution of time, rather than on the amount of time given, that success in this direction depends.

The grouping of classes for singing needs careful attention, and the least successful schools are, as a rule, those in which large divisions are taught together. The music lesson affords unusual opportunities for the lazy and unmusical pupil to neglect his work, so that in a large class of, say, a hundred pupils, only a small proportion may really profit by the teaching. In smaller classes the teacher is able to attend to those details which ultimately produce good results, and, in addition, a feeling of independence on the part of the scholars is fostered.

In the infant school music and singing require the most careful treatment, for it is there that the seeds of future success or failure are implanted. Pattern singing has to be largely adopted, and in doing this, loud, harsh, and cutting tones should never be used in the presence of little children, who quickly, though unconsciously, pick up the tones and gestures of their teachers. The ear in childhood develops so rapidly that impressions are readily received and habits formed which it is difficult to eradicate in after years; and, conversely, the child who habitually hears gentle and musical accents is less likely to grow up with a dissonant voice than one who is always addressed in loud, harsh, and repellent tones. "Musical drill" and "marching exercises" to musical accompaniment are of much service in training the ear to note *accent*—a point much neglected, but of considerable importance in a musical education.

The first step in ear-training is to teach children to distinguish between sounds *high* and *low*, *long* and *short*, *loud* and *soft*, and to imitate such sounds sung by the teacher. Next should follow the imitation of short phrases of two or three notes, to be succeeded by rhythmic and melodic phrases in which the ear is trained to time and tune simultaneously. Children in both infant and senior schools take great interest in these exercises, and show much aptitude in their performance. The imitation of phrases in time and tune, combined and separate, should not be confined to the infant school and Standards I. and II., but the exercise should be carried through all the standards. Variety may be secured by patterning the phrase sometimes to *laa*, sometimes to the names of the notes, and sometimes to words, and by using parts of the melody of songs, ballads, and other compositions.

It should be clearly understood that *telling the names* of notes sung to *laa* or other syllable is a *result*, not a *means*, of ear-training. By carefully-graduated stages the scholars should first be trained to feel the mental effect of each tone of the tonic chord, and its relation to the key-tone in different keys. The remaining tones of the scale may then be similarly introduced, and in this way the training of the ear will accompany the teaching of note-singing from the modulator and blackboard, instead of being dissociated from it, as is frequently the case.

The naming of three tones of the diatonic scale in stepwise succession is required in Division III., and it is at this stage that many think ear-training begins. This erroneous idea is the frequent cause of non-success in this all-important branch of musical education. In naming three tones the child's difficulty is with the *first* note, and the method suggested in the preceding paragraph will aid in overcoming this. It is also a good plan to require the children to name only the *first* tone of a phrase in the early exercises, and afterwards give the names of the succeeding tones. An adult is better able to think of the whole phrase, but with a child it is not so; for the sound of the second note, added to the effort of recognising and remembering the *first*, is an almost sure cause of grasping nothing in the attempt to reach all.

With such preliminary training, the requirements of Division IV. should not only be successfully met by the majority of scholars, but if the exercises are varied, systematic, and educational in character, the scholars generally will derive much pleasure and profit. Successful results, however, cannot be obtained in ear-training unless the children have first acquired the habit of concentration of mind, one of the chief characteristics of good disciplinary training.

No *elaborate* course of voice-training exercises can be generally adopted in elementary schools, but the general principles of voice production should be insisted upon both in infant and senior schools. Loud, coarse singing of songs or exercises should be at once put down, and soft, musical tones substituted. This much, at least, can be done in every school. In the past, not only has the singing been frequently unpleasant to listen to, but the habitual abuse of the voice registers, together with an excessive waste of breath, could

not fail to cause physical injury. Singing under such circumstances loses its refining influence, and encourages noisy and boisterous conduct.

It should not be forgotten that *purity of tone* is the first thing to be aimed at; and when this has been procured, the volume of the tone can be increased without difficulty. Powerful tones produced purely are not accompanied by that sensation of force and effort which spoils otherwise good singing. To produce pure tone, attention must be paid to the posture of the singer, to the formation and opening of the mouth, and to the economy of breath. Nature's arrangement of the voice registers should in all cases be adhered to, and this alone would abolish much of the harshness which characterises the singing in many schools.

It is scarcely necessary to point out that the chief defect in school singing is that it is often much too loud and coarse; indeed, in some cases, "bawling" seems to be encouraged. Where this is the case, the proper use of the registers of the voice is not understood, with the result that the singing drops in pitch, the quality of voice is coarse and unpleasant, and physical injury is often done to the voice. The abuse of the voice during childhood is one cause of the dearth of good singers amongst the general public.

Again, singing in parts is very faulty, and, unless required by the Code, it is better to avoid part-singing than to cultivate a false impression of the beauties of harmony. The faulty part-singing is frequently due to the adoption of an irrational system of selecting the treble and alto voices. In mixed schools it is a very common thing to find all the boys of the highest class singing the alto, whilst the girls try to sustain the treble part. Such an arrangement is radically wrong, and each part suffers; for the singing in such cases may frequently be said to consist of a strong and loud alto part, accompanied by a weak and overweighted treble—a result which needs no further description.

It is absolutely wrong to classify children thus for singing, since there is as large a proportion of natural altos amongst girls as amongst boys. The only satisfactory mode of operation is to classify the voices of both boys and girls according as the best *quality* of their voices is found, on examination, to be in the upper or lower part of the voice. It is not the *range* of voice, but the *quality* in different parts of the range, that should determine the *part* to be taken by the singer. The rounder and fluty tones of treble boys give fullness to the thinner sounds of the girls, and, on the other hand, the alto part is improved by the addition of the sweeter and more refined voices of the girls.

The introduction of part-singing too early is productive of evil, causing much slipshod and inaccurate singing. The alto part, which is often very low in pitch when taken by children of seven or eight years of age, frequently develops into a low growl, and the voice by continual practice becomes coarse in the low tones and weak in the higher sounds. This constant singing of low tones does much harm to young voices.

The choice of school songs requires attention, and in nothing is a greater want of judgment and good sense shown than in the selection of songs by many teachers. Many of the songs published for schools are namby-pamby, sentimental creations of a would-be composer, whose efforts are not improved by the renderings given, which, although imperfect, are quite worthy of the words and music. Some teachers aim too high, and choose songs of which both words and music are beyond their pupils. The error of teaching the treble and alto parts of a four-part song is slowly but surely being recognised, and it is rare now to find that almost incredible ignorance of musical effect which prompted some individuals to teach to equal voices four-part music composed for mixed voices, the tenor and bass parts being sung an octave higher than they should be, and frequently rising above the treble part.

It is much to be regretted that in many schools very little attention is paid to the *method* of teaching music, and the exercises given are seldom preconceived, little care, if any, having been taken to secure sequence in the teaching, or variety in the style of exercise. This is the most fertile cause of disaster when a stranger subjects a class to the test of performing a musical exercise.

Modulator exercises, besides being varied in *style* and *pitch*, should be made interesting by variety in *speed* and *rhythm*. On no account should they be allowed to consist of a monotonous, drawling succession of sounds of equal length and speed. This is, unfortunately, too often the case, and what should be a pleasant exercise becomes most wearisome to the children.

Three general rules may be suggested for adoption by teachers of music in schools. They are as follows:—

1. Never sing *with the pupils*.
2. Insist on soft singing, so that the voice registers may be properly used, and pure tone produced.
3. Prepare your lessons beforehand, so that the exercises may be varied, interesting, and educative.

Teachers of music would do well to carefully study Appendix IV. of the "Revised Instructions applicable to the Code of 1901," from which the following extract is taken:—

VOCAL MUSIC: GENERAL OBJECTS.

Some of the objects sought for in including vocal music in the school curriculum may be stated as follows:—

To provide a healthful and pleasant form of collective indoor occupation, and, through the words of the songs, a possible moral and educative force. Words, as a rule, are more permanently memorised through music than in any other way.

To develop musical faculties in order that children may in after life be able to appreciate the best music as listeners and performers.

To furnish knowledge of musical facts and notation that will enable children to read simple music at sight, and generally to understand music intelligently.

To train and preserve the voices of children, not only with a view to the attainment of tasteful and agreeable execution during school life, but with a view to the potentialities of the children as adult singers.

To store children's memories with patriotic, national, and folk songs, the words of which are suitable for school use. Such an aim does not necessarily exclude or condemn the use of other music found useful and interesting for school entertainments and other purposes.

To cultivate the power to sing tunefully in parts, not only for present edification and culture, but to fit children to become in after life executants of the rich repertory of choral music which we have inherited in this country, and which is continually being added to by living composers.

## OUR ILLUSTRATED GEOGRAPHICAL NOTEBOOK.

### GIBRALTAR: IS IT NOW THE KEY TO THE MEDITERRANEAN?

CALPE and Abyla, the Pillars of Hercules, for ages marked the extreme limits of enterprise by Mediterranean navigators. It was said that the two rocks were bound together until rent asunder by Hercules, to facilitate his passage to Cadiz. Calpe is the modern Rock of Gibraltar, and Ceuta now stands on Abyla, the eminence on the opposite African shore.

When the Moors descended upon Spain in the eighth century, they were quick to note the strategic value of the Rock, where they promptly erected a fortress to assist in their operations. At varying intervals it changed hands, with the fluctuating fortunes of the Crescent and the Cross; but in later times the Spaniards strengthened it, until it was considered almost impregnable, and retained possession of the stronghold until the War of the Spanish Succession.

Sir George Rooke, with a combined fleet of British and Dutch ships, lay inactive off Tangier. Gibraltar was reported to be but weakly garrisoned, and on August 1, 1704, the British commander made a dash for Gibraltar Bay. Ill prepared for attack, the Spanish governor made a brave attempt to beat off the assault; but the attacking forces landed at three distinct points, and overcame all opposition. Formal possession was taken at one point by Prince George of Hesse, who was present, and who, in addition, was a claimant to the Spanish throne. Nevertheless, the Union

Jack was hoisted on the authority of Sir George Rooke, and possession claimed in the name of Queen Anne. The seizure of the Rock was followed by many negotiations for its peaceful surrender, varied by intermittent attempts to regain it by force. Fierce as were the struggles between Moslem and Christian for the coveted stronghold, they were completely eclipsed by the sanguinary and protracted siege that commenced in 1779 and lasted until January 1783. The British garrison never exceeded five thousand men, whom death, wounds, and sickness speedily reduced in number.

The combined land and sea forces of France and Spain were hurled against the Rock. Forty-six sail of the line, floating batteries, and innumerable gun and mortar boats battered the town and searched the defences with terrible effect; but General Elliot and his dauntless garrison were equal to all emergencies, as evidenced by the destruction of the whole of the floating batteries and a great portion of the fleet on September 13, 1782. In February of the following year peace was declared, since when the history of Gibraltar has been practically uneventful.

The opening of the Suez Canal in 1869 caused the Rock to become of supreme importance as a watch-dog on the British route to India and the East. Continual improvements have been effected to render the fortress impregnable, and docks and moles have been provided to increase the natural naval facilities. In 1895 the British Government proposed to spend one and a half millions for a new dock, and for moles for torpedo defences; which in 1896–7 gave way to a more ambitious scheme, involving an expenditure of four and a half millions.

From our sketch-map it will be seen that the town of Gibraltar, the docks, moles, and all the military and naval appurtenances, are situated on the western shore of the Rock; and herein, it has been pointed out, lies a grave peril. The rapid improvements in modern artillery have rendered the defences of Gibraltar of doubtful value. Guns have now an effective range of 10,000 yards, smokeless powder renders their position invisible, and heavy ordnance can be moved from point to point with greater ease than has hitherto been thought possible. From the forts (marked by heavy dots) proposed by the Spanish authorities in 1900 it would be possible to concentrate a converging fire from seventy heavy guns that would prove well-nigh irresistible, and which the batteries of the Rock would be unable to silence, owing to the difficulty of correctly gauging the exact source of attack. On the other hand, it is claimed that in case of hostilities, the occupation of Spanish territory within gun-range of Gibraltar would present no insuperable difficulties.

From the report of a committee appointed to inquire into the matter, it would appear that without a fleet Gibraltar does not command the strait, and a fleet lying in the bay would be dominated by the Spanish forts, so that nowadays the true value of the Rock is little more than sentimental. It is, however, pointed out that docks and harbours, even with severe risks, are preferable to the situation that would obtain without them.

It is generally agreed that it is necessary to very materially strengthen the position, and this can only be done by establishing new works on the eastern side of the Rock. The site presents almost insurmountable obstacles, since the whole shore is marked by precipitous cliffs rising straight from the sea. The village of Catalan is one of the most favourable spots, but it is little more than a sloping ledge, backed by unscalable heights, from which huge boulders occasionally come tearing down upon the little colony of half-Spanish, half-Italian inhabitants, the descendants of some shipwrecked Genoese who have made their home there. Whatever works are erected will be exposed to the full force of the Levanters, and will necessitate breakwaters of great stability. A sanguine estimate puts the cost down at five millions, and the time occupied at ten years; but much may happen in that time.

The possible peril of Gibraltar suggests the idea that the key to the Mediterranean need not of necessity lie on the northern shore of the strait, and in some quarters it is held that Ceuta is infinitely superior for the purpose. In time of war, the civil population of twenty thousand in Gibraltar would be an embarrassing factor for the military authorities, and the food supply would be dependent upon Morocco.

Ceuta is one of the few possessions left to the Spaniards, who use it as a penal settlement. It is backed by a fertile territory, and the position would lend itself to all the military and naval works necessary to form a practically im-

SKETCH MAP OF GIBRALTAR.

pregnable stronghold. Can Gibraltar be exchanged for Ceuta? Spain would probably be willing, since the British occupation of the Rock is a continual menace to her *amour propre;* and France would be likely to acquiesce if in return we left her free to solve the destiny of Morocco.

In the meantime, the strengthening of Gibraltar will proceed apace, and in the time of need it will probably be found that the Rock over which the British flag has floated for nearly two hundred years is not by any means so effete as alarmists would have us believe.

Gibraltar is a Crown colony, with an area of less than two square miles. The population is about twenty-five thousand, including the garrison of over five thousand, and no person is allowed to settle without express permission. The present governor is General Sir George White, the heroic defender of Ladysmith, and in him are vested all the functions of government and legislation. In 1898 the total tonnage of the vessels that entered the harbour was 4,328,859, of which more

than three-quarters was British. The legal currency is that of Great Britain, but Spanish coins are largely in common use.

The situation of the Rock is beautiful in the extreme; and its delightful and healthy climate, luxuriant gardens, rich in magnificent trees and gorgeous flowering plants, leave an indelible impression upon the visitor. In the "long, unlovely street" the motley crowd of Jews, Turks, infidels and heretics, Arabs in picturesque dress, Moors dark and majestic, British soldiers in brilliant uniforms, pretty women stepping daintily along, create a picture to be matched nowhere else in the world.

# NOTES OF A LESSON ON GLASS.

BY WILLIAM DONE, B.A.,

*Head-Master of Brighton Pupil Teachers' School.*

*Articles of Illustration:—*

**See Supplement presented with this Number,**

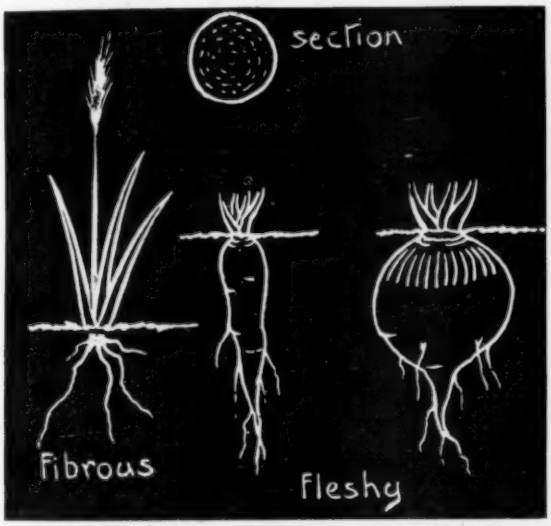
a handful of fine sand, a pennyworth of sodium sulphate, a handful of lime, a piece of coke, a piece of clay, a tin pencil-holder, examples of window-glass, plate-glass, flint-glass in the form of a wine-glass, a piece of soft glass tubing, spirit-lamp or gas-flame.

| Heads. | Matter and Method. |
|---|---|
| *I. Some physical properties of glass:—*<br>(*a*) *Transparency.*<br>(*b*) *Brittleness.*<br>(*c*) *Imperviousness to air.*<br>(*d*) *Insolubility in liquids.*<br>(*e*) *Hardness.* | Refer to the glass in the school windows, and elicit that it is transparent, and yet it will not allow air to pass through it. Drop a thin glass bottle on the floor, to show the brittle character of the material. Let the children name purposes for which glass vessels are used. Elicit that such vessels do not impart any extraneous flavour to their contents. Hence infer that glass is not dissolved by any liquids with which the children are acquainted.<br>Try to scratch a piece of glass with a slate-pencil or an ordinary knife. Thus infer that glass is very hard. We need a diamond—that is, the hardest substance known—in order to cut glass. Note the picture of a glazier's diamond in the diagram. |
| *II. Effect of heat on glass.* | Take a piece of soft glass tubing. Hold it in the flame of the spirit-lamp, revolving it slowly. Very soon the part which is in the flame becomes red-hot, and soft enough to be easily bent, and even to be pulled out into a fine thread. |
| *III. Different kinds of glass.* | Show the different specimens of glass—window-glass, plate-glass, etc. Let the children note the light green tinge of window-glass and plate-glass, and contrast with the crystal-like appearance of the cut wine-glass, which is a specimen of flint-glass. |
| *IV. How glass is made.* | If the teacher has a piece of platinum wire and a blowpipe, it is easy to make a glass bead in front of the class. Melt a little carbonate of soda on a platinum loop, and at once dip it into some very fine sand. Place again in the blowpipe flame, and when all effervescence has ceased, a clear glass bead is obtained. |
| (*a*) *The materials used.* | Next show the ordinary composition of a piece of window-glass. Set out on a piece of paper little heaps of these substances in the following proportions: twenty parts of sand, ten of sodium sulphate, five of lime, one of coke or other form of carbon.<br>Explain that such materials, melted at a great heat, will form glass like our specimen of window-glass. |
| (*b*) *The melting-pots.* | Show a piece of clay. Elicit from the children's knowledge of brickmaking that clay will stand enormous heat, especially fire-clay. Some of the best fire-clay comes from Stourbridge in Worcestershire. For melting the materials of which glass is made, large clay pots are used similar to those in the diagram, holding several hundredweight of the mixture. Our common window-glass would be made in a pot like that for crown-glass. |
| (*c*) *The furnace.* | The melting-pots are placed in a furnace or oven, often dome-shaped, and which is itself lined with fire-clay, and so capable of standing an intense heat. It takes about sixteen hours to thoroughly melt the mixture. |
| *V. The glass fashioned into sheets as for window-glass.* | Stick the pencil-holder into the red-hot end of a piece of soft glass tubing. Note how the holder adheres to the glass.<br>Explain that the glass-worker has an iron tube about five feet long, called a blowpipe, with which he, in a somewhat similar manner, takes up a quantity of molten material from the furnace. By blowing down the tube the glass is made to assume a pear-shaped form, as in the diagram. [If the teacher is somewhat expert, he may get a bulb by blowing down a piece of soft glass tubing into a fused knob at the end.] The workman swings his rod with the pear-shaped vessel attached to it backwards and forwards like a pendulum, by means of which the glass takes the form of a long cylinder with closed ends, as seen in the diagram. Such a cylinder may be about four feet long. He then stops up the end of the blowpipe with his thumb, and places the other end of the cylinder in the mouth of the furnace. The increased heat causes the imprisoned air to expand and force open the cylinder at this soft end. The other rounded end to which the blowpipe is attached is cut off by drawing a thread of red-hot glass round it, and then touching it with a cold iron tool, so causing a clean fracture. The cylinder being slowly cooled, is cut down its length by a diamond, and, after being softened again by heat, is rolled out flat. |
| *VI. Plate-glass.* | In making plate-glass, the melting-pot is lifted by a crane over an iron table, as we see it in the diagram. Some of the molten metal is poured out and spread evenly over the table by an iron roller until it is all of the required thickness.<br>If we were to see such a plate of glass, it would not be clear and polished as we know plate-glass, but somewhat rough, and not transparent. It has to be ground and polished by being rubbed upon another similar sheet with fine sand and emery. |
| *VII. Flint-glass.* | Show a good wine-glass or other article made of flint-glass. Note its clear crystal appearance, and the absence of the greenish tinge found in the window-glass and plate-glass. The materials of which flint-glass are made differ slightly in their composition and proportions from those of which window-glass is made. Sand, however, is an indispensable ingredient of all glass. The other materials are more or less fluxes for enabling the sand or silica to melt at a lower temperature.<br>We notice also that the crucible in which flint-glass is made differs from the other melting-pot. These crucibles are so arranged in the reverberatory furnace that the opening in each pot is opposite to an opening in the wall of the furnace, so that the pots can be filled and discharged from the outside. |
| *VIII. Conclusion.* | A few questions put at the close of the lesson will lead the children to see what a useful and artistic manufacture is that of glass. It is a very ancient one. The old Egyptians made glass vessels hundreds of years before the Christian era. Perhaps no glass, however, has ever rivalled that produced in Venice during the Middle Ages, such as we may see for ourselves in the British Museum. |

# HOW TO COMPILE NOTES OF LESSONS.

BY T. HUDSON,
*Head-Master of Kepler Board School, Leeds.*

In writing notes of lessons, the student should endeavour to express himself as concisely as possible. He should remember that it is not a composition exercise upon which he is engaged, and therefore long, involved sentences are not only not needed, but are entirely out of place. One or two suggestive words are much better than a long, complex sentence. For instance, if a teacher is writing notes of a lesson on "Evaporation," and wishes to state the fact that there is much more evaporation in the tropics than in England, the phrase "Greater in the tropics" on a line by itself would be much better than the following sentence: "As water evaporates much more readily in the hotter regions of the earth, there is much more evaporation in tropical regions than in England." The mistake generally made is that the notes so called are not *notes* at all, but long, complete statements. As I write, I have before me notes of a lesson containing a statement consisting of two principal and two subordinate sentences. Each of these should have been made into a short, simple sentence or phrase, and these short sentences should be written on separate lines.




BLACKBOARD SKETCH: NOTES OF A LESSON ON ROOTS.

One of the best notes of lessons I have seen, I found one day on a pupil teacher's desk. The teacher was giving a geography lesson in the ordinary routine of school work. The subject was a first lesson on British North America. On the desk was a paper, on which were pencilled such suggestive words as "Distance," "Time to go," "Greyhounds of Atlantic," "Banks of Newfoundland," etc. These are truly *notes*, and if needed only by the teacher are all that is necessary. But in writing notes for an inspector something more is required. The notes must suggest not only to the teacher, but also to the inspector, the matter which is going to be imparted, and they must also show how that matter is going to be taught. Hence, in the majority of oral lessons, two columns are required—matter and method. These should, in most cases, fairly balance one another.

I should recommend a teacher, when beginning to write notes of a lesson, to first decide upon the heads of the lesson. Then roughly write down all the items of matter, using short sentences, and as far as possible write each item of fact on a line by itself. When the matter has thus been gone through, consider how each fact is going to be taught, and fill in the method column accordingly. The separate items of matter should be numbered, and opposite these, in the method column, should be a line similarly numbered. When the rough draft has been completed, it will show whether it is necessary to make the matter column wider than the method column, or *vice versâ*. As a rule, it will be found that they will need to be about equal in width.

One of the most common mistakes made by young teachers is to mix up the matter and method. I have before me notes of a lesson on cork. In the matter column are only nine lines, while in the method column there are sixty-one lines, but more than half of them are statements of fact—that is "matter." Questions had best be omitted, and the answer to a question is certainly not "method." Do not hesitate to use the word "tell" in the method column when necessary, but do not add what you are going to tell, for that would be matter.

The following rules, briefly summarising the foregoing remarks, should be carefully observed:—

1. Express yourself as briefly as possible.
2. When possible, let there be a fact in a line, and opposite it how that fact is going to be taught.
3. Keep matter and method columns (when used) distinct.
4. Omit questions and answers.

The following lesson on "Roots" will serve to illustrate the foregoing remarks, and will show how most notes on *object* lessons should be compiled. In subsequent issues model notes of lessons on standard and class subjects will be given.

## NOTES OF A LESSON ON ROOTS.

*Standard II.——Time—30 minutes.*

*Requirements.*—Roots of various plants—for example, carrot, radish, turnip, liquorice—to be brought by the children.

| HEADS. | MATTER. | METHOD. |
|---|---|---|
| *Appearance, etc.* | 1. The root of a plant is nearly always under ground.*<br>2. Young roots are generally white.<br>3. Older ones generally brown, but may be red, purple, etc.<br>4. Young roots are tender.<br>5. Old roots are hard, woody, and very tough.<br>6. Nearly all roots are round (in section).<br>7. The root always grows downwards. | 1. Show a plant. Children name and point to the parts.<br>2. Show young roots of any weed or plant.<br>3. Show radish, turnip, carrot, liquorice, etc.<br>4. Break one in front of class.<br>5. Let children try to break liquorice root.<br>6. Cut several. Let children tell shape.<br>7. Children tell. |
| *Kinds.* | 1. The roots of many plants are like small white threads or *fibres*.<br>2. These are called fibrous roots.<br>3. Others are thick and fleshy, and are called fleshy roots.<br>4. Fleshy roots are of various shapes. | 1 and 2. Write fibres and fibrous on blackboard. Show fibres in cloth, etc. Compare fibrous roots of weeds.<br>3. Write on blackboard. Show carrot, turnip, etc.<br>4. Let children draw some of the specimens. |
| *Uses.* | 1. Holds the plant firmly in ground.<br>2. Gets food for plant out of the ground.<br>3. Fleshy roots are used as food by men and animals. | 1. Children to tell.<br>2. Draw attention to drooping plants before and after watering.<br>3. Obtain uses of some fleshy roots, and then generalise. |

* Neglect aerial and parasitical roots.

## CERTIFICATE SYLLABUS FOR 1903.

In reply to our inquiries at Whitehall, we have received a letter from the Board of Education "to state that the Syllabus for the Certificate Examination of 1903, which will be attended by acting teachers, has been for some time under consideration, and will shortly be issued."

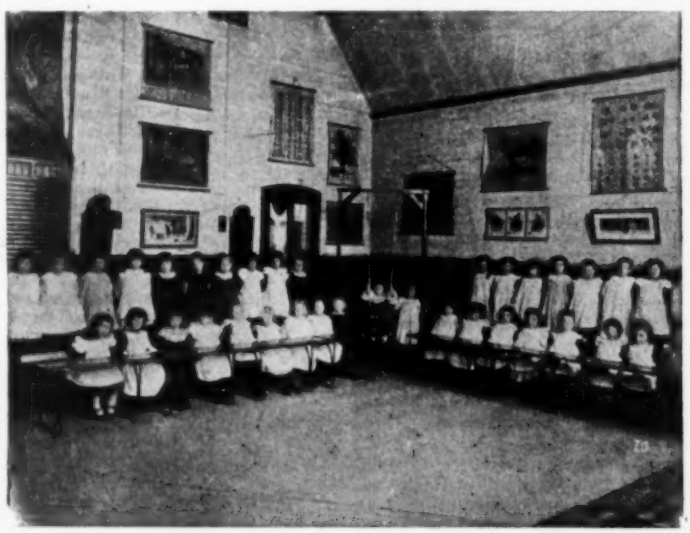
# The Practical Infant-School Teacher.

## A MODEL INFANTS' SCHOOL.

WE asked our representative to call on a well-known teacher of an infants' school in one of the large towns of the Midlands; and although he was most kindly received and shown the work of the school, and permission was given to use the visit for the purpose of an article in THE PRACTICAL TEACHER, it was distinctly laid down that neither the name of the school nor that of the mistress should be made known in the article. On it being pointed out that our articles on "Well-known Teachers at Work" were not given for puff or advertisement, the mistress, with some reluctance, granted us the favour of being allowed, if any reader wished to know more about the school and its methods, to give the name, if application for it be made to this office. We wish it to be distinctly understood that whatever appears in these columns is written with the express purpose of giving help to teachers of similar schools, and for no other reason. We are convinced, from the many letters we receive regarding these articles, that they have been of great assistance in introducing new methods of teaching, and encouraging teachers to persevere with innovations they have introduced into their work when they were tempted to give up in despair.

Here is a school in one of the suburbs of a large town, presided over by an enthusiastic mistress, and assisted by an able and willing staff—a school under the control of a progressive School Board, and under the supervision of one of the most genial and encouraging of H.M. Inspectors it would be possible to find in the United Kingdom. It is attached to a large mixed department, the headmaster of which acknowledges with gratitude the help he receives from the splendid management and teaching which prevail throughout the whole course of work. It is well equipped with materials and appliances which enable its instruction to be based purely and entirely on kindergarten principles. The head-mistress has been devoted to this system of teaching through all her career, and had the courage to introduce it into the school where formerly she worked under the same Board at a time when teachers, as a rule, fought shy of it, and were rather afraid of what H.M. Inspector might think of it. Indeed, at the time he *was* somewhat prejudiced against it: but after seeing its value as a means of bringing more beauty and light in the school-life of the little ones, he sided with it, took a fancy for it, and has become an enthusiastic advocate of it—but not with the kindergarten that is largely accepted, not the kindergarten that begins and ends with "gifts," "embossing," and such like, but the kindergarten that appeals to the touch, the sight, and the constructive faculties of the children. Every subject taught is based on these principles, and all things are correlated one with another. How this is done will be demonstrated later on.

The school contains a central hall, in which one class is taught. Its walls are tastefully decorated with such pictures and ornaments as appeal most keenly to children of tender years, and which, at the same time, can be made use of in the lessons that are given. Their arrangement is an object lesson in neatness and carefulness. Not a picture is out of place, not a case is disarranged. It is the duty of one of the pupil-teachers every morning and afternoon before the children assemble to see that all things are in their proper place. The head-mistress's desk is placed at one end of the hall, and on it and around it are to be seen plants and flowers of every kind—a palm forest in miniature. On the morning of this special visit—a visit "without notice"—the leaves of the palms, aralias, aspidistras, and ferns had all been sponged, and the plants watered with affectionate care. There, near the desk, is a dovecote. Two birds are the dwellers therein, but, at the present moment, 10.15 a.m., they are not at home. One of them is confidently perched on the edge of a desk where a little girl is copying with unconscious irony the word "butterfly" from the blackboard on her paper. She takes no notice of her feathery visitor, and so cannot see how longingly the bird desires, as it looks at the well-formed tracery, it were a real dainty instead of its name. The other is feeling its wings, flying now here, now there—at one moment lighting on the floor and strutting about, and at another flitting from ledge to cupboard-top, from cupboard-top to roof of cote. The children are used to these aërial flights, and lessons are not disturbed. It might be thought that such inhabitants of a school would leave objectionable traces of their occupancy; but assurance is given



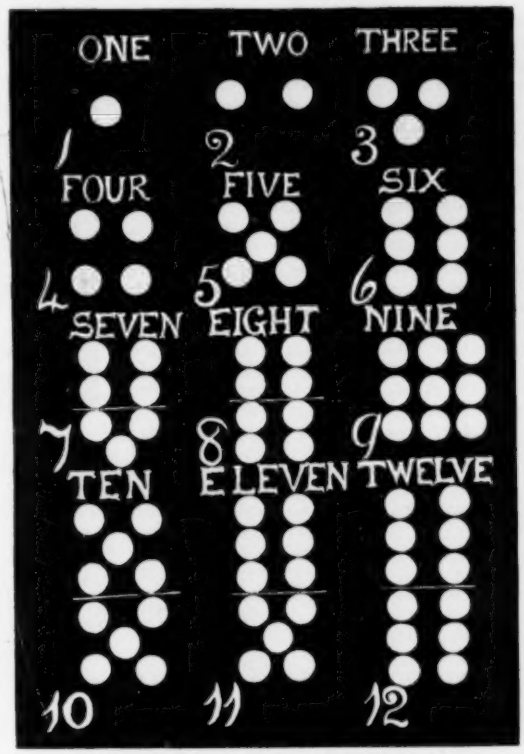
DESK ARRANGEMENT FROM DAY TO DAY.

that such is not the case. The cote was beautifully clean, and showed that careful supervision is constantly given to it. This is the work of one of the boy monitors. At the other side of the desk is an aquarium. It is the home of many kinds of fish, the receptacle of half-holiday prey, the outward and visible sign of Saturday afternoon sport. A tortoise has been kept, a hedgehog has found shelter here; but both have come to ends that must be accounted sad. There are two museum cupboards—one on each side of the hall, and these are filled with illustrations for object lessons and specimens of the children's handicraft. In every respect it is a palatial school hall. Four exits and entrances lead to it from the playground through two spacious corridors. Attached to these are cloak-rooms and lavatories, a small lavatory being placed at each entrance. This arrangement is found to be very convenient, as each class, or nearly so, can have its own lavatory. A teachers' private room is situated over one of the corridors—the wider one. Round the hall are six class-rooms, one of which, however, without much inconvenience to the department, is used by a class from the upper school. This we shall not notice.

It is astonishing how, after a few minutes' cordial conversation, the reticence and the desire of the head-mistress not to be held up to professional criticism, and possibly jealousy, has in a measure disappeared as the mist of the early morn. She is now going to disclose the mysteries of the classes. We can see them busy at work through the glazed doors, and we enter the room set apart for the babies. This is a most interesting class, and well worthy of a whole morning's visit. We will get through it as quickly as possible. An air of happiness is present—the happiness that comes from doing what is congenial and pleasant. There is a wonderfully strange influence at work. It comes from the brightness, the pleasant face, and the smile of the teacher. The voice is clear, and sympathetic, and winsome. The children are drawn to the teacher by golden threads of affectionate attachment. The class is not arranged as we know classes are ordinarily arranged. The desks are placed round three sides of the room in double rows, the centre of the room being free from all obstruction. This seemed to be an improvement. It certainly allowed the teacher freedom in her movements, and during recreative lessons there would be no necessity to move the desks for the purpose. A swing, a lounge, a see saw, and such like appliances for rest and play, are ready at hand to be used when required, which is pretty often, for the mistress quite believes these things necessary to inculcate in the young children a love for school. Illustration No. 1 shows the desk arrangement from day to day. It is near the end of the school year, so that the average age of the children is about four. The children are actually writing from dictation, and on tiny slips of paper, too, with lead pencils. The teacher sounds a letter, *dĕ* (this is difficult to express; it should be heard), and down goes *d* on the paper. Other letters, and combinations of letters, not exceeding two, are sounded, and the dictation is complete. Nearly all the papers are accurate, and this leads to a discussion as to how writing and word-making are taught.

First, as regards writing. In the earliest stage of all, the children are each provided with a square wooden tray, the sides measuring about twelve inches. These contain a small portion of fine glass sand, just about enough to well cover the bottom. A slight shake of the tray causes the sand to lie evenly for use. With the first finger of the right hand—and this is important—lines are drawn from left to right to correspond with the teacher's ruled lines on the blackboard. Then in the lines are drawn the strokes, the letters, and what not in the sand. As advance is made, the children use a pencil instead of the finger, care being taken at the very commencement to hold the pencil accurately. The sand-trays are also used in the early drawing and number lessons in much the same way as in writing. Afterwards paper is used, as in the schools of Switzerland. A good rule, and one which prevails right through the two departments of the school, is that no rubbing out whatever is allowed. When once a letter, a figure, or a word is down, it is never touched or altered. In drawing-lessons, no india-rubbers are used. Care with the work must inevitably be the consequence of such a practice.

Word-making is taught purely on the phonetic system. No letter is ever named except by the sound it represents; *d* is *dĕ*, *mat* is *m* (sounded with lips shut), *ă* (ah), *tĕ*, and so on. The alphabet is not learnt as an alphabet. The letters




LOT PICTURES FOR NUMBER TEACHING.
(*Reduced.*)

are learnt from their shape, and from their sound. Letter O is learnt first. The materials in use for letter-learning are The "Register" Series Alphabet Book, separate letters printed on flat square cardboard, and cubes, on the six faces of which letters are printed. The children use these cubes as though they were playthings. A letter is printed by the teacher on the blackboard in coloured chalk, named by its sound by the children, and then found on the cube. It would be awkward to use the cubes for word-making, so the flat squares are used for this purpose. Coloured chalks are used, because colour is prettier than white, and therefore has more fascination for the child; and inasmuch as teacher can say *blue b*, or *brown t*, colour is constantly being called by its name, and correlation is seen in colour-lessons and the reading or word-making lesson. The kindergarten principle comes in from the fact that the child is constantly *doing* all these words for himself, making them, constructing them. The very fingering which is necessary on the part of the child to turn the cube over in its search for the right letter is kindergarten work.

Number is taught on the constructive principle again, and always by means of pictures—dot-pictures. One dot, of course, is *one;* two dots (and these always side by side), *two*. From these all the other numbers are obtained. By adding picture *one* to picture *two*, picture *three* is obtained, and this is always in the same form. A glance at the illustration No. 2 will readily show what is meant, and the reader will easily see how addition, subtraction, multiplication, and division are taught by means of such picture numbers. But just one more word about them. It is possible to put five dots in any position, and in counting this is done; but when they happen to come in the recognized picture form the children call it by the name of "nice picture five," accent

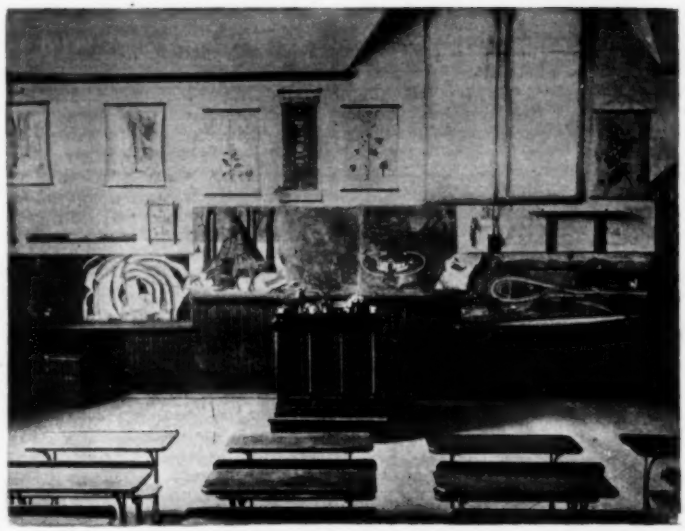
on the *nice*. The children draw these "nice" pictures on their slates, and in the sand, and by the side of them they put the figure, whatever it may be. In such a number-picture as picture six, slate pencils are used in teaching division and multiplication. By putting two pencils across the picture horizontally three twos are made—"three twos are six," "twos in six three;" and by putting one pencil vertically between the dots two threes are seen, and the children say, "two threes are six," "threes in six two." With little ingenuity a great deal can be done.

The recreation work of the babies is exceedingly varied. It takes the following forms—drawing, paper-folding from drawings, fraying, and all kinds of games. One is almost afraid to write down their names, they are so numerous. They include the see-saw, swing, guessing, story telling, reading of pictures, and making collections of various kinds of things. No wonder the little ones like to come to school! How they enjoy a guessing-game! Let one be described. It is so tempting. *Teacher:* "I have something in my pocket. You often use it at school. It is rather long—it reaches from the bottom of my pocket to the top. It is smooth and round. It may be red, or black, or blue; and as I pass my hand along it I find that one end is flat, and the other comes to a sharp point. I must be careful not to prick myself. What is it?" *Children:* "A lead pencil." Teacher then asks why a certain child thought it was a lead pencil, and if a child can say, "Because you said it was smooth, and came to a point, and we used it at school," she knows full well that during the telling part the child was thinking, and was undergoing mental training.

Counting is done during see-saw and swing recreations, and here is an example of how even play can be correlated with work.

Object teaching is a speciality of the school, if indeed one subject can be truthfully said to take a premier place. The schemes of lessons do not appear to include much work, but they are so exhaustively done, and so minute are the details brought out in the teaching, that short though the schemes appear, they contain each a good year's work.

This is the scheme for the babies:—1. The donkey compared with the horse. 2. The cat compared with the dog. 3. The sheep compared with the cow. 4. A bird. 5. A fish. 6. A tree. 7. A letter and its postage. 8. (Girls) Laying a table. 9. (Girls) Making dolly's bed. 10. Our garden, and the tools we work with. 11. Winter.



A WELL-ARRANGED ROOM.

By referring to a teacher's notes on object lessons, one is completely taken aback by the amount of knowledge that is conveyed by these lessons. No less surprising is it to see how close is the connection between the child and the subject of the lesson. Stuffed animals—pretty large ones—represent the fish and bird section, while there are also at hand the live specimens mentioned earlier in this article. Toy animals, and pictures, and models illustrate lessons 1–3, and there are in addition several portions of these animals available for use—a horse's hoof, a cow's hoof, paws of the cat and dog, for example. A tree finds many illustrations. There are plenty about the school, and among them a real little orange tree. It is decaying now, but at the time of its use it fortunately showed leaves, a flower, a green orange, and one nearly bursting with ripeness. A boy acts the postman and brings the letters, real ones; and there is a wonderfully true representation of a pillar-box, with a little girl putting a letter in it, drawn full size on the large wall blackboard, which runs throughout the length of one of the walls. The whole blackboard, in fact, is covered with object-lesson drawings. It must be mentioned here that four of the classrooms of the school are named after the seasons of the year. The baby room is "Winter." There are special reasons why it should be so called, but they are not of general interest, so we shall say nothing about them. In winter the postman is busy with his deliveries, especially at Christmas time. In winter snow is on the ground. The babies of this room borrow the dovecote from the hall, call it a house—the top is exactly like the roof of a house—cover the roof with a mantle of white cotton wool and call it snow, and to make the resemblance the nearer to the real thing fix a robin-redbreast on the wool. They scatter crumbs on the floor, rub their hands, pretending it is very, very cold, and the picture is complete. What is learnt in object lessons is used in other lessons. The winter scene is crudely drawn, mental arithmetic—number, however, is the proper word, as arithmetic in its real sense is not employed—comes in when legs, feet, etc., are counted and questioned about. But we must not stay too long in the babies' room, however distressing it may be to leave such a soul-inspiring place. But while on the subject of object lessons we will cross the hall to the room

THE MAYPOLE DRILL.

used by the first (highest) class. Illustration No. 3 shows the room—large, well-lighted, well-arranged, but empty of its children. The pictures immediately over the wainscoting are drawn by the teacher to illustrate the year's course of object teaching. There is something unique in the drawing of these pictures. It is this. The teacher makes no attempt to complete the drawing at one "sitting." She draws a little one evening, a little the next, and so on till completion is arrived at. In the morning the children spend a few minutes looking at the picture, and after being asked, point out the additions or alterations that have been made overnight. This is an easy matter, as any one can see, when the pictures are in their first stages; but afterwards the keen and intelligent observation of the children is demanded, if they are to point them out. Some wonderful stories are told about the remarks some of the children have made from time to time.

The room is "Summer." Its decorations are therefore floral as far as possible. Pressed daisies form one of the pictures. Flowers brighten the teacher's desk. The subjects of the object teaching are—modes of travelling, dwellings, and messages. The drawing on the right shows every possible method of travelling. Walking, running, cycling, horse-riding, driving, travelling by rail, by motor car, and canal, are all depicted. There is a balloon, too, showing aërial travelling. A farmhouse represents an ordinary home, a caravan shows a nomadic home, a castle the home of a king. The home of an Esquimau is shown in the centre, not very clearly, while the two on either side of it show the wattled dwellings of Indians and South Sea Islanders. And what about the messages? Well, their means of being taken or sent are all there. There are railway signals, a letter-carrier, flags on the castle tower showing how silent messages are conveyed. Two people talking illustrate oral communication. The whole scheme is most admirably depicted in colour, and the lessons are beautifully complete. On another wall hang other pictures representing other parts of the lessons. One that must not be omitted shows what arrangements are necessary for telegraphing and for posting. The minds of the children are thoroughly opened out. Their attempts at describing the object lessons on paper are really clever, and their original letters are most amusing. Take the following as an example :—

THE GOLDEN BOAT DRILL.

*September 2nd, 1901.*

*My dear Uncle,—I have been to Salford Priors, and the plums where not quite ripe, I did not have any plums, nor any damsons, but I had some pears, they where very nice.—With love from*

*SIDNEY BUTLER.*

We said, when describing the recreative lessons of the babies, that they were numerous; but they are numerous, too, in the higher classes of the school, and are equally enjoyed by the children. There are drills with garlands, scarfs, rings, hoops, and wands. The Maypole (Illustration No. 4.) and the Golden Boat (Illustration No. 5.) are two of the most popular. In the Golden Boat—the music (with instructions) for which can be obtained from almost any music dealer—all the children can be used; and this is a highly-instructive pastime. It is the work of Mrs. Ormiston Chant. In the Maypole game, two Maypoles are used, one with braids, the other with art-muslin. These are lighter forms of physical exercises. When muslin is used the effect is very pretty. There are twenty-four pieces shaded gradually, piece by piece, from white to dark terra-cotta, with shades of green alternated between. The colour effect is charming. Girls only take this exercise, and perform it with regular steps. The children here take the valse step, the pas-de-quatre step, and steps that have been arranged at the school and may be called original. With braids figures are formed; but as this exercise is pretty generally made use of in infant schools, nothing further need here be said of it except to point out that in addition to its being performed in the hall of the school, a socket for holding the pole has been sunk in the playground and in the floor of the upper school, so that on fine days and on special occasions the dance can be performed in these places. On May Day of each year the children of both departments join together in a May Day Festival, and revel in Old English pastimes.

Now as regards one or two special points. Clay modelling forms one of the subjects taught to the older children, and on the morning when a visit was paid, of which this article is the result, such a lesson was to be seen. The object to be modelled was a plum. Each child was provided with a good, well-shaped specimen. The teacher—a pupil teacher on this occasion—was demonstrating for the purpose of criticism. On her little table was placed a tennis-ball (sphere), an orange (a flattened sphere), a lemon (an oval), an egg, and a plum. The demonstration was very clearly made, and the shape of the plum was produced in clay by means of the children moulding it in their fingers through the shapes indicated here. In previous lessons the tennis-ball, lemon, etc., had been the objects made. When the plum was complete, as far as the clay was concerned, the stalk from the pattern plum was inserted in its proper place, the line of the plum was drawn by a slate pencil from stem to end, and the whole was finished. The next lesson will be half a plum, when the stone will be taken from the real plum and inserted in that made of the clay. Clay modelling seemed to be a perfect "occupation." The fact that the children handled and worked with their fingers, observed and imitated, exercised their faculties of judgment and the like, tended to produce most excellent training of hand, and eye, and mind. The only thing wanting in the exercise was colour.

Exercise in colour is provided for by brush drawing. No lesson was in progress, but specimens of work were abundant. Some of it was so excellent as to make one almost doubt that the children had been the artists. But great things have of late years been done in infants' schools in this subject, so that there is no room for doubt as to the drawing of these excellent specimens. This subject is taught at first by lessons in brush-holding and placing, colour mixing, short straight lines and curves, until by-and-by flowers, easy designs, and copies are the result. The mistress was most enthusiastic in her belief that this is one of the most inspiriting subjects of the school. She wonders how it is that teachers do not adopt it more generally than they do. She does not believe that they who say it is difficult can have made a trial of it. She believes that brush drawing inculcates self-

progress even more than clay modelling, and points out how many children there are who at home have their box of paints, and who bring the result of their attempts to school to be admired. This cannot be the case with clay modelling; for although a child may, after a rainy day, make an object of dirt, so to speak, it cannot have their affection and admiration as a coloured drawing can have. Freearm drawing on large sheets, drawing with pencils and rulers, and copying pictures from books, with imaginative drawing thrown in, constitute the various branches of drawing taught. This is one of the subjects that is most helpful to the master of the upper school. The children who excel in it in the infant school can be traced right up to Standard VII. of the upper department, and there, to say the least, it is magnificent. Mentioning the upper school in this way, quite casually, one is bound to notice the fact that there is perfect agreement of practice and principle. The little ones often borrow reading books, drawing copies, maps, etc., from the upper school, and they are always most willingly lent. Indeed, the children are encouraged to borrow.

Silk rearing is largely carried on. Hundreds of eggs are saved each year, and many of the children know almost as much about the silkworm and its productions, its life and metamorphoses, as do the people who rear them for profit's sake.

A striking thing about the instruction is that the children enter into the questioning quite as much as they do the answering. They make their own problems in arithmetic, tell stories as they imagine them or remember them at the moment, and on some subjects little speeches are made. On one occasion it is remembered that an argument was logically conducted by a little fellow with one of the inspectors, a London M.A. And no wonder! This spirit prevails in all the work. True education is at the bottom of it all. The mistress is a member of the local branch of the British Child Study Association, and so are several of the staff. The child is understood, and the child is trained in the best sense of the word.

But how comes this unanimity, so clearly seen in the various classes? How is it that the principles on which the work is done are so well understood by the staff? It is because at stated times the mistress and teachers confer with each other, and discuss points that have arisen in the teaching. How is it that the work throughout is so up-to-date and on the best recognised principles? It is because both mistress and staff are student-teachers. The teachers' library contains the best educative works that can be obtained. They are read, discussed, and known. The staff is as one person. And where does the orginality come in that is nowadays so much sought for and encouraged? Here. The teachers are thoroughly alive. They are on the *qui vive* to notice how sometimes by an accident a new idea is born. It becomes common property by discussion, and if, after a trial, it is found worthy of retention, it is adopted. An instance will show. One day, one of the teachers was explaining horizontal and vertical lines, and for the sake of simplicity was calling them "lying-down" lines and "standing-up" lines. She wished for an easy term by which to call a slanting line, and taking hold of a boy who was standing in front of the class, and who had been used to demonstrate "standing-up" and "lying-down" positions, she gently moved him through space from the vertical to the horizontal position. In doing so, she noticed that he stiffened himself as though he were afraid of falling. "See," said the teacher, "he is afraid of falling. I think we had better call them 'falling-down' lines," and "falling-down" lines they are called to this day.

At the sound of the twelve o'clock bell lines of children are seen waiting for a signal for them to march out. A pupil-teacher takes her seat at the piano in the hall; she strikes a chord, pauses, then plays a march, and on the first note of the march out the children troop. Not straight home, but

## TIME-TABLE OF A MODEL INFANTS' SCHOOL.

| Class. | | 9 to 9.30. | 9.30 to 10.5. | 10.5 to 10.40. | 10.40 to 11. | 11 to 11.15. | 11.15 to 11.50. | 11.50 to 12. | 2 to 2.15. | 2.15 to 3.10. | 3.10 to 3.20. | 3.20 to 4. | 4 to 4.20. | 4.20 to 4.30. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I. 1. 2. 3. 4. 5. | MONDAY. | Bible Repetition. | Writing. | Reading. | RECREATION. | Mental Arithmetic. | Arithmetic. | DRESS AND DISMISSAL. | Word Building. | Hand and Eye Training. | RECREATION. | Physical Exercises. Varied Occupations. Object Lesson. Varied Occupations. Object Lesson. Physical Exercises. | Recitation or Conversational Lesson. | DRESS AND DISMISSAL. |
| I. 1. 2. 3. 4. 5. | TUESDAY. | Old Testament Story. | Reading. | Arithmetic. | | Physical Exercises. | Writing. | | Story Telling, or Oral Composition. | (Boys) Drawing. (Girls) Needlework. | | Varied Occupations. Physical Exercises. Varied Occupations. Object Lesson. Var. Occ. or Weak Subject. Varied Occupations. | Singing. | |
| I. 1. 2. 3. 4. 5. | WEDNESDAY. | Learning or Singing Hymns. | Reading. | Object Lesson. | | Recitation. | Writing. | | Conversational Lesson. | Drawing (Brush or Freehand). | | Blackboard Arithmetic. " " Physical Exercises. Varied Occupations. " Dance or Weak Subject. | Tables and Counting. | |
| I. 1. 2. 3. 4. 5. | THURSDAY. | New Testament Story. | Reading. | Arithmetic. | | Physical Exercises. | Writing. | | Guessing Games, or Local Topics. | (Boys) Drawing. (Girls) Needlework. | | Var. Occ. or Weak Subject. Object Lesson. Blackboard Arithmetic. Physical Exercises. Varied Occupations. Object Lesson. | Singing. | |
| I. 1. 2. 3. 4. 5. | FRIDAY. | Moral Lesson. | Arithmetic. | Reading. | | Mental Arithmetic. | Writing. | | Word Building. | Composition: Letter Writing, or Picture Reading, Drawing from Picture, Nature, Modelling Object, or Own Object brought. Sorting for Babies. | | Object Lesson. Var. Occ. or Weak Subject. " " " " Physical Exercises. Kindergarten Game. | Dictation or Conversational Lesson. | |

Registers are marked 9.5 a.m., and closed at 9.30; in the afternoon, marked 2.5 p.m., and closed at 2.20.

A criticism lesson is given on the first or third Tuesday of each month at 11.30 a.m., or 4.0 p.m. All the teachers are present at the criticism, all classes but one being dismissed for this purpose.

Stumping is also taught to the babies as a variation to drawing.

to the corridors they go. Here they have their appointed places. Clothes are distributed, the tiny ones are helped into them, and soon the merry shouts are heard beyond the walls. But all is not over yet. Several of the children return, and edge their way to the mistress; but as they see she is engaged with a stranger, they stand aloof, and wait respectfully for her to notice them. They have brought some specimens of work they have done at home, an article of interest they want her to see; they have a puzzling question (to them) to ask, they want to know one this, one that. The mistress is glad to see them, but hands them over to the senior assistant. This is a fine trait in the character of the school. Trust in mistress, trust in child, must inevitably result in splendid success.

The departure of the anxious ones gives an opportunity of discussing the Code. It is brief. There are only two points therein that the mistress desires to see altered or amended. She thinks that only drills for the manipulation of the apparatus required in knitting and sewing should be demanded in all classes except the highest. She is also dissatisfied at the continued large number of children under the charge of one teacher. She would limit the number to fifty at the very most. To have all things one desires except two is to be in a very happy position. It shows how near to the ideal we are little by little reaching. May the time soon come when *nothing but what we have* is desired.

## A METHOD OF TEACHING NUMBER TO INFANTS.

BY C. M. A. COOMBS, L.L.A.

ARITHMETIC is so essentially a mental discipline, that it should be studied in our schools in the best possible way. To make this subject liked by the children in upper schools, it is necessary that the elements be clearly, logically, and pleasantly taught. The following are a few notes on a method which has proved very successful in more than one school.

**The Principles.**—1. The method is based upon the fact that children of three to four years can only conceive three consecutive similar objects at once, hence we deal with threes.

2. The same picture of the number is adhered to throughout.

**The Apparatus.**—The apparatus is most important. It should be different for each day, each child being provided with same. The following is a very good arrangement:—

Monday.....Rings.
Tuesday.....Gift III.
Wednesday.....Coloured beads.
Thursday.....Sticks (red and white).
Friday.....Teacher only to have apparatus.
Every day.....Cards specially prepared.

**Notes on Apparatus.**—*Rings.*—Brass curtain rings are the best. They are given to the children in the tin saucers.

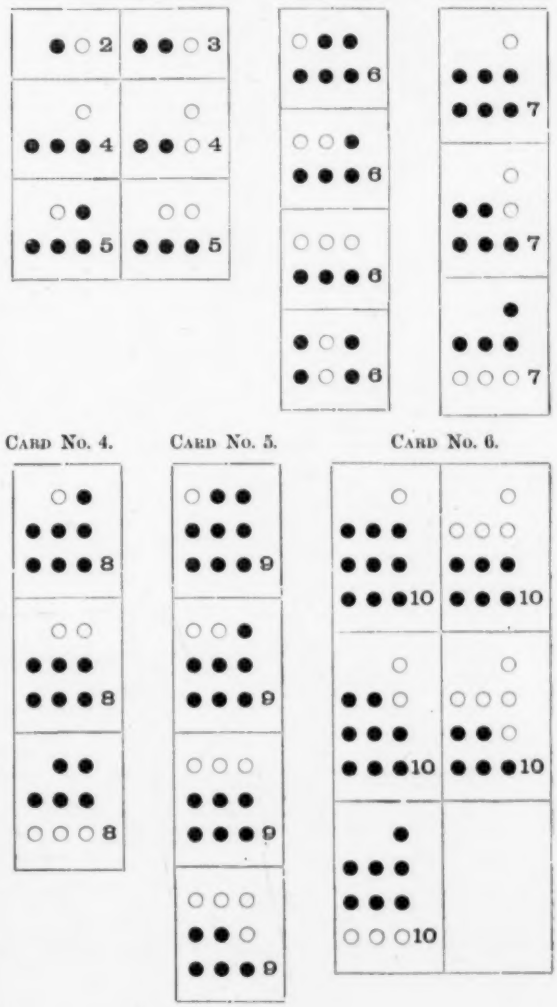
*Gift III.*—In using Gift III., after opening to drill, the cube should be pushed back as far out of the way as possible, and the bricks taken off as required. The teacher should always use the large box of Gift III., and she will find it very useful to colour the face of her cubes as necessary with chalk. Or better still is the abacus which has been brought out for use with this method.

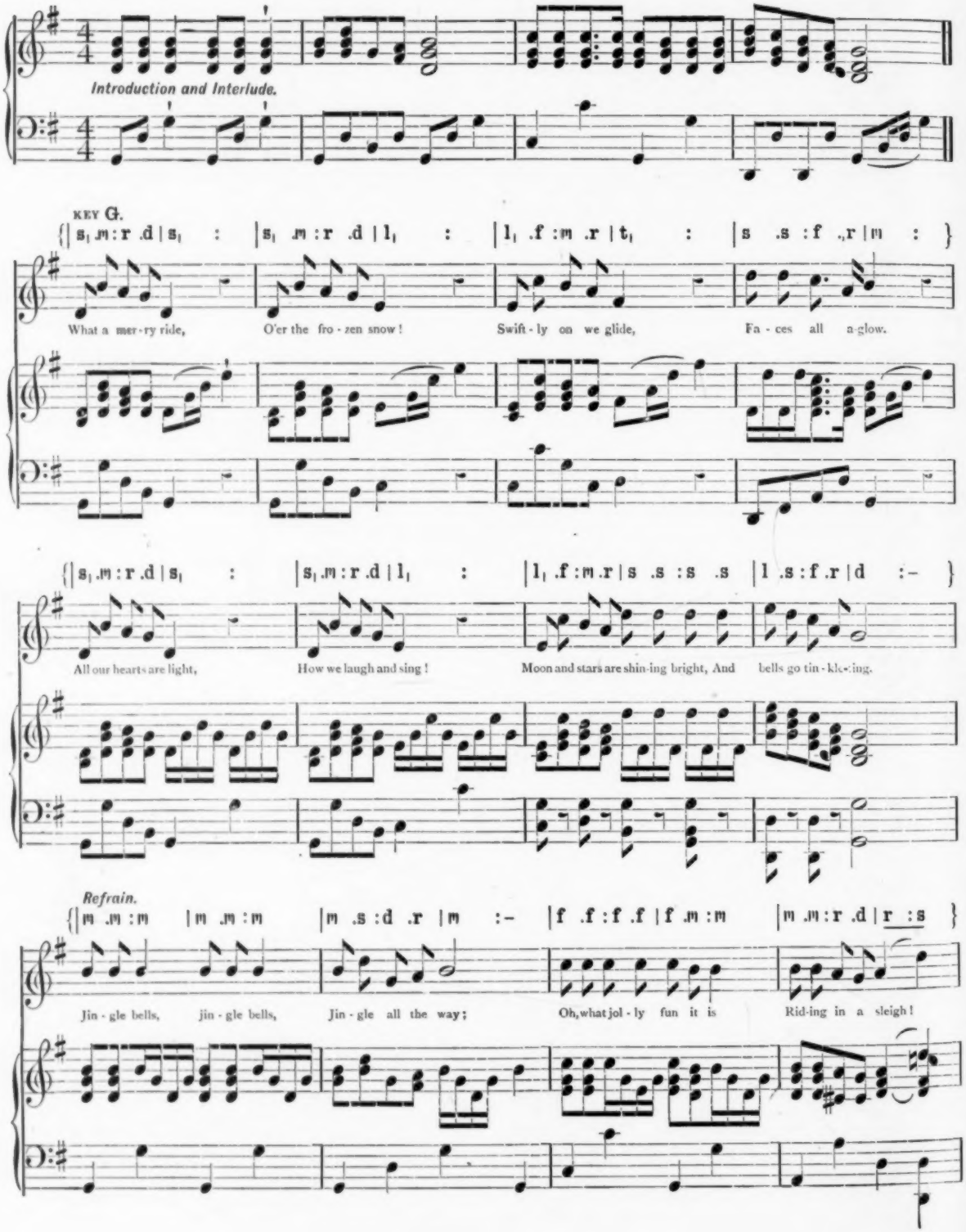
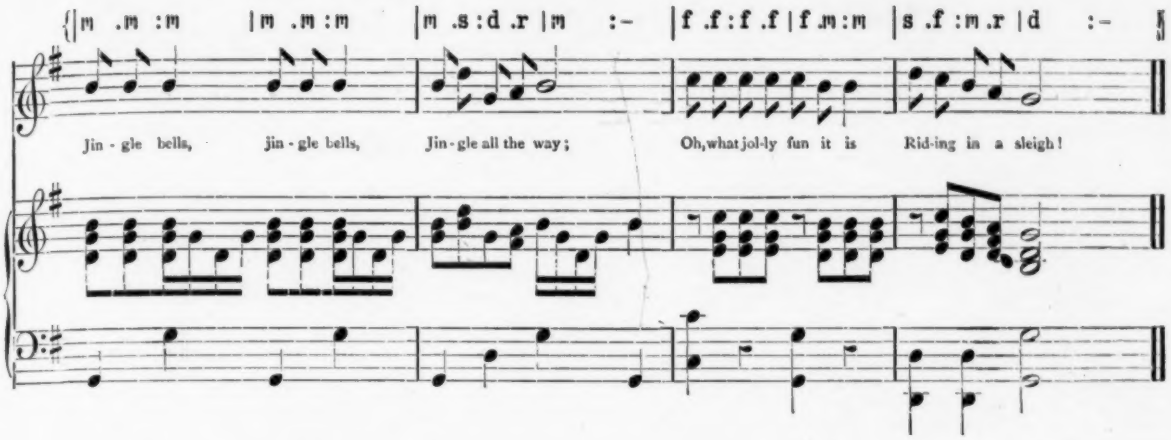
*Beads.*—The beads should be in threes, thus—three red, three yellow, three blue. They need not all be used, but not less than three of any one colour should be supplied to each child.

*Sticks.*—Bundles of sticks all one length should be given to each child. Half the bundle should be red and half white. The sticks can very easily be stained with red ink.

*The Cards.*—The cards are easily made. Cut disks of red and black, about size of a penny, out of paper-folding paper, and stick on a white card. The cards must never be less than 18 inches by 12. These cards should show the analysis of each number, the new card being introduced with the new number. The card should remain in a conspicuous place. (See diagram cards.)

**The Method.**—The method is simple. Begin with number 2. Children to place one ring on one thumb, and second ring on other thumb. How many thumbs? How many rings? Call them pennies: how many? Take one ring away: how many left? If buns, and we eat one: how many left? And so on. Place one white dot and one red on blackboard. Two we now know. Place another brick by two bricks: how many? Practise in this—two and one are three, one and two are three. Also subtraction. Now two white dots and one red one on blackboard. Four is three white dots and one red one on top—right-hand side. Analyse and build up as before. Use blackboard and cards well. Each number is to be thus dealt with, teacher marking well the threes. Sometimes they are placed at the top, sometimes at the bottom. Here we get our four, with three at the bottom. With five and two we get five white ones and two red ones. All the numbers, ten included, should be thus dealt with. The accompanying diagram of cards is more useful than words. It will be found that, at the end of the third quarter of the year, the apparatus can be discarded. The children's apparatus should be placed like the diagrams.



# AN INFANT-SCHOOL SONG: JINGLE BELLS.

Introduction and Interlude.
KEY G.
What a mer-ry ride, O'er the fro-zen snow! Swift-ly on we glide, Fa-ces all a-glow.
All our hearts are light, How we laugh and sing! Moon and stars are shin-ing bright, And bells go tin-kle-ling.
Refrain.
Jin-gle bells, jin-gle bells, Jin-gle all the way; Oh, what jol-ly fun it is Rid-ing in a sleigh!

WHAT a merry ride,
O'er the frozen snow!
Swiftly on we glide,
Faces all aglow.
All our hearts are light,
How we laugh and sing!
Moon and stars are shining bright,
And bells go tinkle-ting.
*Refrain.*—Jingle bells, jingle bells,
Jingle all the way;
Oh, what jolly fun it is
Riding in a sleigh!
Jingle bells, jingle bells,
Jingle all the way;
Oh, what jolly fun it is
Riding in a sleigh!

2 Ting-a-ring-a-ring!
Dobbin, get along;
Sleighing's just the thing
For a merry song.
See the snow-wreaths fly
As we make the pace;
Not a birdie in the sky
Could beat us in the race.
Jingle bells, jingle bells,
Jingle all the way;
Oh, what jolly fun it is
Riding in a sleigh!
Jingle bells, jingle bells,
Jingle all the way;
Oh, what jolly fun it is
Riding in a sleigh!

3 Let the pony go
Fast as e'er he will,
Dobbin's sure to know
When we reach a hill.
What a merry ride!
How we speed along,
Seated snugly side by side,
And joining in a song!
Jingle bells, jingle bells,
Jingle all the way;
Oh, what jolly fun it is
Riding in a sleigh!
Jingle bells, jingle bells,
Jingle all the way;
Oh, what jolly fun it is
Riding in a sleigh!

This is a bright and breezy song, extremely well adapted for children's voices. Much use can be made of bar and sleigh bells, particularly during the Refrain, which may be repeated if thought desirable. The actions of driving, holding the reins, whipping the pony, etc., should alternate with the ringing of the bells, or should be done by the boys while the girls manipulate the bells.

***Next Month: Musical Games for Infants.***

# AT OUR INFANTS' DEPARTMENTS.

## H.M. INSPECTOR'S VISIT WITHOUT NOTICE.

*No. on books, 405. Children divided into seven classes.*

| | | | | | |
|---|---|---|---|---|---|
| *Class I. consisting of children 5 and 6 years of age; a few 7 years.* | | | | | |
| *Class II.* | ,, | ,, | ,, | ,, | |
| *Class III.* | ,, | ,, | ,, | ,, | |
| *Class IV.* | ,, | ,, | *4 and 5* | ,, | |
| *Class V.* | ,, | ,, | ,, | ,, | |
| *Class VI.* | ,, | ,, | *3 and 4* | ,, | } *Babies.* |
| *Class VII.* | ,, | ,, | ,, | ,, | |

As the end of our school year approached, bringing no second visit from H.M. Inspector, we secretly hoped that for once it was deemed unnecessary to visit us again. It occurred to us that possibly H.M. Inspectors might be exceptionally busy, or that the results of our work on the occasion of the first visit were so satisfactory that we were to be excused a second ordeal. The authorities, however, had decreed otherwise; for on an intensely hot morning late in July (the day previous to closing for summer holidays), H.M. Inspector walked in before nine o'clock, looking provokingly cool in "flannels." On being asked by the head-teacher how he could think of coming on such a morning, the inspector jocularly replied, "How could I stay away?"

The inspection was conducted much on the usual lines. There was no new departure. The bulk of the work was taken by the teachers, H.M. Inspector supplementing their questioning, here and there, in a very bright and playful style.

Whilst Classes III., IV., and V. were assembled in the central hall for religious instruction, the inspector visited Classes I. and II. in their respective classrooms, giving reading tests on the blackboard as follows:—

*Class I.*—"Our dog is very funny. He has a cold in his head. He will not go to school to-day. Nor can he sing the old songs now."

*Class II.*—"One day a fat cat came into our shop. A fine lady came in and saw it. What fun we had!"

Reading-books were not asked for in any of the classes.

The same classes were next questioned by the inspector in number. There was nothing formidable in the questions, which were put in problematic form, beautifully wrapped up in a succession of imaginary impossibilities; indeed, I am not at all sure that the young hopefuls were not busy following their teacher "careering on a bicycle over a church steeple," instead of concentrating their efforts upon giving the required answer. These questions were asked by H.M. Inspector:—

"Tommy came to our apple tree, and got 6 apples. He ate 3. How many left? Then he got 7 more. How many had he? He gathered enough to make 11. How many did he get? His mother put 3 into a pie. How many left? Then he came to our tree for 6 more. How many had he?"

Other questions necessitated the following mental calculations:—

12 − 1, 20 − 14, 5 + 5 + 5, 16 + 4, 19 + 19, 27 − 13.

The teacher of each class was left to conduct her writing lesson in the usual way, and the work done was afterwards examined by the inspector. Capital and small letters and a sentence were shown by each class.

Class III. was visited next, and the following test in reading printed on the blackboard by H.M. Inspector:—

"Bad Sam put a box of pins in the dog."

By a skilful manipulation of the pointer, the sentence was also rendered by the children,—

"The dog put bad Sam in a box of pins."

"A box of pins put bad Sam in the dog."

The teacher of this class took both number and writing, whilst the inspector looked on.

In Class IV. the inspector supplemented the teacher's questioning on number 8, and put the following to the children:—

"I had 6 white rabbits, and 2 black ones. How many? I took these rabbits into school, and placed them in fours before the desk. How many fours were there? I took these rabbits into town, and 4 sprang over the church spire. How many were left?"

The reading lesson here was taken by the teacher, whilst the inspector remained in the room. The following words were built up:—Ate, late, gate, Kate, etc., followed by the sentences read in phrases, "Kate was late; she was in the lane," "The lad sat on the gate."

Whilst Class V. was engaged in an object lesson on "The Cow," H.M. Inspector asked the children a few easy questions on the same subject, and then requested the teacher to take a number lesson. A writing lesson followed, and the work done (small letters) was examined. No test was given in reading to this class.

H.M. Inspector went back to Class III., and listened whilst the teacher gave a lesson on "A Plant," but took no part in the questioning.

After play, the boys of Classes I. and II. were grouped for drawing (free drawing with coloured chalks on small blackboards), whilst the girls took needlework.

Class IV. also showed needlework and drawing. All the specimens in needlework were carefully looked at.

Recitations were said by two classes:—

*Class I.*—"The Naughty Mousie."

*Class III.*—"The Cat that came to School."

Tonic Sol-Fa was tested in Class I., and afterwards a group of four classes sang a song in the central hall, entitled "Fairyland."

The first three classes concluded the work of the morning by varied occupations.

*Class I.*—Brushwork (cowslip and butterfly).

*Class II.*—Clay-modelling (the cherry). The children were asked a few questions by H.M. Inspector on their work, contrasting the stalk, colour, and edibility with those of the real cherry.

*Class III.*—Paper-folding (forms of beauty).

The inspector asked no questions at all in the Babies' Rooms, but the following work was done before him:—

A number lesson on No. 5.

A very simple word-building lesson.

Kindergarten game—"Birdies."

Recitation—"The Sick Pussy."

Varied occupations—"Stick-laying."

A little before 12 a.m., H.M. Inspector intimated that he would be back in the afternoon for a short time; but as the heat was so trying, and as our visitor had worked so pleasantly and conscientiously, the head-teacher considerately released him at noon. A few minutes after twelve H.M. Inspector left us, expressing himself as being very pleased with the nice work he had seen, and adding, "I know you'll say, 'I'm glad he's gone!'" I am bound to add that we could not endorse that statement. I feel sure that I am voicing the sentiments of the whole staff in saying that we thoroughly enjoyed the visit from H.M. Inspector, who left us quite oblivious of the fact that we had done a hard morning's work.

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# OUR TUTORIAL SECTION

## OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

*Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.*

### SPRING EXAMINATION, 1902.

### Seventh Month—October.

#### WORK TO BE PREPARED.

1. ENGLISH.

*Candidates.*—Gray's *Elegy*, verses 25–28. Learn derivation of important words, noting particularly the suffixes. Analyse the whole, and parse words presenting difficulty.

*First Year.*—The *Expostulation*, lines 161–196, or *The Task*, Book V., lines 193–219, with derivations, knowledge of allusions, etc.

*Second Year.*—*Paradise Lost*, Book III., lines 400–462.

2. COMPOSITION.

One or two essays each week from the list in the *Pupil Teacher's English Notebook.*

3. HISTORY.

*Candidates.*—James I., Charles I., and the Commonwealth—1603–1660.

*First Year.*—The Wars of the Roses to 1485.

*Second Year.*—George I.

4. GEOGRAPHY.

*Candidates.*—Scotland: the counties in detail.

*First Year.*—Asia: physical features, climate, and productions.

*Second Year.*—Central America and the West Indies.

5. ARITHMETIC.

*Candidates.*—Application of recurring decimals to weights and measures.

*First Year.*—General problems.

*Second Year.*—Cube root and its application.

6. EUCLID AND ALGEBRA.

*First Year.*—Euclid: Props. 21–24, with four deductions per week. Algebra: harder problems in simple equations.

*Second Year.*—Euclid: Props. 1–10, with four deductions per week. Algebra: harder problems in equations with two unknowns.

### Notes on the Work for the Month.

1. ENGLISH.

*Candidates.*—GRAY'S "ELEGY," verses 25–28.

*General Paraphrase (continued).*

Verse 25. In answer to his query, some gray-haired villager may say: "We often used to see him in the early mornings, before the sun had barely risen above the horizon, hastening over the dewy grass towards the higher meadows.

Verse 26. "In the hot noontide he used to lie at full length under the shade of yonder beech tree with the old curiously twisted roots, and gaze pensively upon the little stream that wanders murmuring by.

Verse 27. "Or again, we would meet him by yonder wood, engrossed in his thoughts, smiling scornfully, and allowing his wandering ideas to take shape in muttered words. Sometimes he looked sad and depressed, like one who had no friend or companion, or as though he were harassed by great cares or unrequited affection.

Verse 28. "One morning I missed him from the hill, neither did I see him at any time during the day in his accustomed haunts; the second day followed, and he did not appear."

*Notes on Parsing and Analysis.*

Verse 25. *Some.* Demonstrative in this case.
*Brushing.* Imperfect participle, qualifying *him.*
*To meet.* Infinitive of purpose, modifying *brushing.*

Verse 26. *Yonder.* Demonstrative adjective, pointing out *beech.*
*So.* Adverb of degree, limiting *high*, which is an adverb of manner, modifying *wreathes.*
*Would stretch.* This is a form of a past tense used to express repetition of the action. It corresponds to the French imperfect.
*Would.* May be taken as a tense auxiliary, or as a principal defective verb governing *stretch.*
*Stretch* = an infinitive mood.
*Pore.* Infinitive mood, governed by *would* understood.

Verse 27. *Hard.* Adverb of degree, modifying the phrase *by yon wood.*
*Smiling* and *muttering.* Imperfect participles, qualifying *he.*
*Drooping, woeful wan, crazed, crossed.* All refer to *he*, and form its enlargement.
*Like.* Adjective, qualifying *he* and governing *one* in the objective case.

Verse 28. *Morn.* Adverbial objective case.
*Yet.* Adverb of time, modifying *was.*

COWPER'S "TASK," BOOK V.

*General Paraphrase (continued).*

Line 193. When, in the early history of the world, those who had planned and commenced building the Tower of Babel were thrown into confusion by the diversity of languages sent upon them by God, they scattered abroad over the earth; and as the Eastern shepherds lead out their flocks from a common fold in different directions, so some went to the valleys and others to the hills. "The world was all before them where to choose;" there was ample room for all, and all were provided with suitable environments. They were bidden to live in peace, and in peace they lived so long as they confined their ideas to the common occupation of husbandry. They ploughed, sowed, and reaped their harvests in contentment. But this golden age did not last long. Human passions soon broke the universal harmony and serenity. In every breast there is a spark of discontent which, given the occasion, soon grows into an all-devouring flame. Cain slew his brother, and although the crime of murder was for a time washed away by the flood, evil passions still existed in men's hearts. One of his descendants—Tubal Cain—was the first man to devise weapons and instruments of war: at the flaming forge he, like Vulcan, hammered the glowing iron, hitherto used only for the peaceful spade and ploughshare, into the keen-edged sword; and thus, appropriately, the son of the first murderer was the inventor of death-dealing weapons.

*Notes on Parsing and Analysis.*

Line 197. *These, those.* Objects of *drave.*
*Asunder.* Adverb of manner.
200. *Fair and equal in its distribution.* Enlargement of *boon.*
201. *Dwell.* Infinitive, governed by *bade.*
202. *Awhile.* Adverb of time, modifying the predicate.
207. *But.* Adverb of degree.
*Fan.* Infinitive, governed by *needs.*

209. *Unquenched.* Adjective, qualifying *seeds.*
214. *Contriver.* In apposition with *artificer.*
215. *Yet.* Adverb of time, modifying *unbloodied.*
216. *Bright.* Adjective, used proleptically after *made.*
217. *Tubal.* Residual object of *named.* The full form in the active would be, "They named him Tubal." The verb takes two objects: when this is converted into the passive, only one object becomes the subject; the other is *left*—for example, "He was named Tubal." The noun left in this way is termed the residual object.

The proper order of these lines is: *The sword and falchion claim him as their inventor.*

Full notes on the *Expostulation* will be found in the edition published by Messrs. T. Nelson and Sons.

*Second Year.*

All necessary notes on parsing, analysis, and paraphrase are given in the text-book recommended—Milton's *Paradise Lost*, Book III. (Messrs. T. Nelson and Sons).

### 2. History.

*Candidates.—Chief Points:—*

(*a*) Prepare a genealogical table showing the descent of the Stuarts from Henry the Seventh.
(*b*) The plots: Main and Bye (political), Gunpowder (sectarian).
(*c*) The Millenary Petition, Hampton Court Conference, and Authorised Version of the Bible.
(*d*) The Plantation of Ulster.
(*e*) The Parliament; growth of Puritanism.
(*f*) The Stuart ideas of divine right of kings and passive obedience.

*Charles I.*

(*a*) The Stuart ideas of prerogative carried to further excess.
(*b*) The work of the Parliaments.
(*c*) The period of personal rule, 1639–40; Wentworth and Laud; illegal taxation.
(*d*) The attempt to force a liturgy on the Scots.
(*e*) The Long Parliament and the Civil War. (Prepare a table of battles, leaders, etc.)
(*f*) Trial and execution of the king by the Rump (Independents), after the expulsion of the Presbyterian majority.

*The Commonwealth.*

(*a*) The reduction of Scotland and Ireland.
(*b*) Changes in the form of government.
(*c*) The foreign policy of Cromwell—"to make the name of Englishman feared abroad."
(*d*) The rapid fall of republicanism after the Protector's death.

*First Year.*

(*a*) A table of the battles fought, leaders, and results must be prepared.
(*b*) Life of Warwick the king-maker.
(*c*) A note should also be made of the character of the wars.
1. They were fought between the great barons and their armed retainers.
2. They affected the towns and ordinary workpeople but little.
3. They were characterised by cruel ferocity on either side.
4. They resulted in nearly destroying the power of the feudal barons, and so prepared for an era of peace.

*Second Year.*

(*a*) The Riot Act rendered necessary by the unsettled state of the country.
(*b*) The Jacobite Rebellion and passing of the Septennial Act.
(*c*) The South Sea Bubble.
(*d*) Walpole's administration.
(*e*) Irish affairs and Wood's halfpence.

### 3. Geography.

*Candidates and First Year Students.*—The month's work is mainly text-book, and calls for no additional notes. Maps must be freely used.

*Second Year.*—Prepare a table, as follows, of the various states, etc.

| Country. | Area. | Population. | Products. | Towns. | Government. |
|---|---|---|---|---|---|
| Costa Rica | 23,000 sq. m. | 250,000 | Coffee, sugar, caoutchouc, sarsaparilla, dyewoods, tortoise-shell, and fruits. | San José. Punta Arenas. | Republic. |
| Guatemala | 46,000 sq. m. | 1½ millions | As above. | Guatemala. Champerico. | Republic. |
| Honduras | 42,000 sq. m. | 400,000 | Mahogany, fruit, cattle, india-rubber, cedar, cotton, sugar, indigo. | Tegucigalpa. Truxillo. Amapala. | Republic. |
| Mexico . . | 770,000 | 13 millions | Maize, wheat, barley, pulse, sugar, potatoes, coffee, cotton, tobacco, flax, indigo, silver, gold, copper, lead, quicksilver. | Mexico. Vera Cruz. Tampico. | Republic. |
| Nicaragua | 51,000 | 320,000 | As in Costa Rica. | Managua. Leon. Granada. | Republic. |
| Salvador . | 7,228 | 800,000 | Coffee, indigo, tobacco, sugar, silver, balsam, rice, hides, cedar. | San Salvado . | Republic. |

The West Indies need careful preparation. Prepare a map showing those belonging to England and other nations respectively. Note the *coolie* population (hired immigrants from India); the decay of the sugar industry resultant on the abolition of slavery.

### 4. Euclid and Algebra.

The set of questions given below (in Autumn Examination Course) should be worked through. If any difficulty is experienced, send up for solution.

*Test Questions.*

*Candidates.*

1. Analyse the following, and parse words in italics:—
"For thee, *who, mindful* of the unhonoured dead,
*Dost* in these lines their artless tale relate,—
*If chance*, by lonely *Contemplation* led,
*Some* kindred spirit shall inquire thy fate,
*Haply* some hoary-headed swain *may say*,
'Oft have we seen him.'"
2. Give examples of the suffixes denoting *full of, without, diminutive, direction, made of, feminine gender, agent or doer.*
3. What do you know of Ket's rebellion? What important legislation did it lead to?
4. Give some account of the improvements made during Elizabeth's reign.
5. What do you know of the following:—Kyles of Bute, Loch Coruisk, Glenmore, Carse o' Gowrie, Galloway, Trossachs, Strathclyde?
6. Give in tabular form the chief productions of Scotland, and say what you can about any one of them.
7. By what decimal must ·2083 be multiplied to make it 1? Ans. 4·8.
8. Simplify $\frac{7\cdot5 + (9\cdot75 \div 2\cdot4) \text{ of } 1\cdot95}{(7 + 5\frac{1}{4}) \times 7\frac{1}{2} - 15\cdot75}$, giving answer as a decimal. Ans. $\cdot1958\dot{3}$.

*First Year.*

1. Analyse lines 131–138 the *Expostulation*, and parse *as terrible, as if, none for theirs, far too mean*; or, analyse lines 187–192 *The Task*, Book V., and parse *their sport, were, would do, to extort, toy, world.*
2. Give the meaning of the following prefixes, and give examples of words in which they occur:—*ag-, pel-, re-, un-, oc-, se-, en-.*
3. What advance was made in the power of the Commons under the Lancastrian kings?
4. Explain the causes and events which led to the loss of the French provinces in the reign of Henry the Sixth.
5. Give an account of a tour in Switzerland, visiting the chief places of interest.
6. Say what you can of the physical features of the Iberian

peninsula, illustrating your answer by a sketch-map. How are the two countries comprised in it governed?

7. A man takes for the expenses of a tour £20, 18s., and finds at the end of 6 days that the money which he had spent was equal to $\cdot 809523$ of what remained. Find his average daily expenses. Ans. £1, 11s. 2d.

8. Divide £64 among A, B, and C so that A may have three times as much as B, and C may have one-third of what A and B have together. Ans. £36; £12; £16.

*Second Year.*

1. Paraphrase and analyse lines 383–396 *Paradise Lost*, Book III., and parse *made visible, else, therein, that day, warring, disarranged.*

2. What were the chief results of the Norman Conquest on the language of England?

3. Say what you can of Whigs and Tories, Sacheverell, Cabinet, Jacobites, Queen Anne's Bounty.

4. Describe, with a plan, one of Marlborough's victories under these heads:—(1) Where was it fought? (2) why was it fought? (3) how was it won? and (4) what was the result of it?

5. Take six large towns in the United States, say what you can of each, and explain why they are found in the positions they occupy.

6. Describe in detail the government of the United States.

7. Express $\sqrt{1\cdot\dot{2}\dot{7} + 1\cdot\dot{5}71428}$ as a vulgar fraction, reducing it to its simplest form. Ans. $1\frac{8888427}{90000000}$.

8. Extract the square root of $2\frac{2344132}{360036}$. Ans. $1\frac{1442}{2025}$.

## AUTUMN EXAMINATION, 1901.

In the brief space left before the examination, revision of the subjects will occupy most of the student's time. Some back Government questions were given before, which may serve to indicate weak spots.

There are some features of the examination itself which require the most careful attention. In the first place, every pupil teacher finds the time allotted all too short. It is only by very judicious division of time that it is possible to get all the questions answered. Each paper must be timed, and so many minutes allowed to answering each question, which allowance must not be exceeded. Take care to read carefully the instructions given, and obey them strictly. The answers must be arranged neatly and methodically. Tabulate wherever it is possible. Put down nothing but facts, and answer to the point. A long, wandering answer is of little use. Illustrate your geography answers by sketch-maps if possible. Revise your answers, so that no careless slips or errors are left for the examiner. Attempt as many questions as you are permitted to in each paper.

### Points for Final Revision.

*English.*—Life of the author; other works; metre of the poem; prefixes, affixes; history of the language and mistakes in language (second year). (These points are fully dealt with in the *Pupil Teacher's English Notebook.*)

*Geography.*—Governments, trading routes, imports and exports, chief towns, and, of course, those countries given for special preparation.

*History.*—Dates; chief statutes; lives of chief men; wars, battles, and treaties.

*Arithmetic.*—The theory of the various rules. (This is *most* important.)

*Music.*—Make quite sure of all the syllabus. (Not a single mark should be lost in this subject.

### Questions for Revision.

*History and Geography.*—Nearly all the recent questions have been utilised monthly in the course. It might be well to refer to back numbers and see that none have been omitted.

*Deductions in Euclid.*

1. ABC is a right-angled triangle, having a right angle at B. On AB and BC are described squares ABDE, BCFG outside the triangle. Prove that the points E, B, F are in a straight line. (Second Year.)

2. If from the angles of a parallelogram taken in order equal distances in the same direction are cut off from the sides, and the points of section joined, prove that the figure so formed is a parallelogram. (First Year.)

3. From the ends A and B of a straight line there are drawn at right angles to AB, but in opposite directions, two equal straight lines AC and BD, and the points C and D are joined by a straight line cutting AB in E. Prove that each of the lines AB, CD is bisected in E. (First Year.)

4. If a rhombus and a square are described on the same straight line, the area of the square is greater than that of the rhombus. (Second Year.)

5. Construct an isosceles triangle having the vertical angle four times each of the angles at the base. (Second Year.)

6. Find the centre of a circle that shall pass through two given points and have a given diameter. (First Year.)

7. If from the angles of a rhombus taken in order equal distances in the same direction are cut off from the sides, and the points of section joined, prove that the figure so formed is not a rhombus. (Second Year.)

8. Show that the triangle formed by joining the middle points of the three sides of an isosceles triangle is itself isosceles. (First Year.)

9. If two adjacent sides of a quadrilateral are equal, and the angle contained by them is bisected by the diagonal, show that the other two sides are also equal, and that the angle contained by them is bisected by the same diagonal. (First Year.)

10. APB, CQD are opposite sides of a parallelogram ABCD. Prove that the sum of the areas of the triangles ACP, PDB, CAQ, QBD is equal to the area of the parallelogram. (Second Year.)

11. Two equal lines POQ, SOT intersect in a point O such that PO, SO are equal. If TP, QS produced meet in K, prove that KPS is an isosceles triangle. (First Year.)

12. AB, CD are lines bisecting each other. Show that if their extremities are joined, ACBD is a parallelogram. AC is bisected in E, and BE is produced to F, so that EF = BE. Prove that DAF is a straight line. (Second Year.)

13. O is a point within a triangle ABC such that the line OC is greater than AC. Prove that OB is less than AB, and that the angle OAB is less than the angle AOB. (First Year.)

14. PR, PV are two straight lines. Through any point S draw a straight line meeting them in T, W respectively, so that PT may be equal to PW. (First Year.)

15. In the hypotenuse PR of a right-angled triangle PQR a point S is taken so that PS is equal to PQ, and QT is drawn at right angles to PR. Show that QS bisects the angle TQR. (Second Year.)

16. A line AD is drawn perpendicular to the base of a triangle ABC. Show that the line AB is greater than either of the lines AD, BD. (First Year.)

17. O is any point on the line joining the vertex A of a triangle ABC to the middle point of the base. Prove that the triangles OAB and OAC are equal in area. (Second Year.)

18. AB is the side of a square; C is a point in the opposite side. Prove that the triangle ABC cannot be equilateral, but may be isosceles. (First Year.)

19. ABC, DEF are two triangles. The angles B and E are equal; so are the angles C, F; so are the sides AB, DF. Are we justified in inferring that these triangles are equal in every respect? (Second Year.)

20. Given the extremities of a shorter side of a right-angled triangle and the sum of the other two sides, construct the triangle. (Second Year.)

*Problems, etc., in Algebra.*

1. Solve $\dfrac{7}{\sqrt{x+10}} = \sqrt{x+10}$.

Multiplying both sides by $\sqrt{x+10}$, we get $\sqrt{x+10}^2 = 7$, or $x + 10 = 7$.

Ans. $x = -3$.

2. A bag contains 1000 coins—sixpences, half-crowns, and half-sovereigns. There are 250 more sixpences than half-crowns, and the value of the gold exceeds the value of the silver by £81, 5s. Find the number of each coin.

(Let $x$ = number of half-crowns. Then there are $250 + x$ sixpences and $1000 - (2x + 250)$ or $(750 - 2x)$ £; and by the question $x$ half-crowns $+ 81 \times £5 = (750 - 2x)$ £.

3. My class are seated in four equal rows, and I put enough pencils for them; but the mistress takes 4 of the pencils, and the monitor breaks $\frac{1}{8}$ of what is left, so that I have only enough for three rows. How many children are in the class?

(If $x$ = number of pencils, then $x - 4 - \{\frac{1}{8}$ of $(x - 4)\} = \frac{3}{4}x$.)

4. I have £1, 8s. 6d. in florins and half-crowns. Had the florins been crowns and the half-crowns shillings, I should have had £1, 4s. How many florins had I?

5. I take a number and add 25 to it. One-twelfth of the sum is, I find, equal to one-seventh of the original number. What number did I take?

6. The number of girls in a school is 18 more than half the number of boys. When 5 per cent. of the girls and one-seventh

of the boys are absent, there are 15 more boys present than girls. How many children are in the school?

(Let $2x$ = number of boys; then $x + 18$ = number of girls, and $\frac{9}{10}$ of $x + 18 = \frac{4}{5}$ of $2x - 15$, etc.)

7. The sum of the cubes of two numbers, when divided by the sum of the numbers, gives a result equal to the square of the sum of the first number and $\frac{1}{3}$ of the second. The second being 105, find the first.

(By question, $\frac{x^3 + 105^3}{x + 105} = x + 35$. Dividing out the first fraction, $x^2 + 105x + 105^2 = x + 35$. Then as ordinary quadratic.)

8. How do you show that $x^p + x^q = x^{p+q}$, where $p$ and $q$ are integers?

($x^p = x + x + x + x$ to $p$ terms.
$x^q = x + x + x + x$ to $q$ terms.
$x^p + x^q = (x + x + x$ to $p$ terms$)\,(x + x + x$ to $q$ terms$)$
$= x + x + x + x$ to $p + q$ terms
$= x^{p+q}$.)

9. If 352 persons give each as many pence as the cost of collection comes to in shillings, and the charity thus receives £12, 15s., how much does each give?

10. Had a farmer's flock of sheep been three times as large as it actually was, the number remaining after he sold 35 would have been five times as great as it was in reality. Find the size of the flock.

Give a reason for one of the following being a wrong way of beginning the working of this problem:—

(*a*) Let $x$ = number of sheep in the flock.

(*b*) Let $x$ = sheep in the flock.

(*b*) statement is wrong, although it is a very common mistake. The letters in equation stand for definite numbers, and $x$ cannot equal *sheep*. Similar mistakes occur in saying, "Let $x$ = the distance," without specifying feet, yards, etc.)

11. In a division the majority was 140, which was $\frac{7}{17}$ of the whole number of voters. How many voted on each side?

$525 + 385$.

12. How would you find whether $x - 1$ and $x + 1$ are factors of an expression in $x$?

(Arrange the terms in ascending or descending series, putting ciphers for any power of $x$ omitted. Then if the sum of the coefficient of the odd terms = the sum of the coefficient of the even terms, the whole is divisible by $x + 1$. If the total sum of the coefficients = 0, it is divisible by $x - 1$.)

13. Two clubs, A and B, play a cricket match. A wins the toss and goes in. On the first innings of each side B is 25 runs ahead. A in the second innings makes $\frac{2}{3}$ of what it did in the first, while B only makes $\frac{1}{2}$ of what it made in the first, and A wins by 11 runs. Find the score of each side in each innings.

Let $x$ = number of runs scored in A's first innings. Then B scores $x + 25$. In the second innings A scores $\frac{2}{3}x$, B scores $\frac{1}{2}(x + 25)$.

Then $x + \frac{2}{3}x = x + 25 + \frac{1}{2}(x + 25) + 11$.
$x + \frac{2}{3}x = x + 25 + \frac{1}{2}x + 12\frac{1}{2} + 11$.
$\frac{1}{6}x = 48\frac{1}{2}$.
$x = 291$. A's innings, 291 and 194.
B's, 316 and 158.

14. If on Monday I had cycled 4 miles less, I should have ridden a distance equal to $\frac{3}{5}$ of the distance actually ridden on Tuesday. Had I cycled 5 miles more on Tuesday, I should have covered $\frac{3}{4}$ of the total distance actually travelled on the two days. What was the total distance?

Let $x$ = number of miles covered on Monday.

Then $x - 4 = \frac{3}{5}$ of the number on Tuesday.

$\therefore$ the number on Tuesday $= \frac{5(x-4)}{3}$, and the total number of miles $= x + \frac{5(x-4)}{3}$.

Now $\frac{5(x-4)}{3} + 5 = \frac{3}{4}\left(x + \frac{5(x-4)}{3}\right)$;

or $x = 25$ miles on Monday,

$\frac{5(x-4)}{3} = 35$ miles on Tuesday.

Total = 60 miles.

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## SCHOLARSHIP EXAMINATION, 1901.

### Tenth Month.

WORK TO BE PREPARED.

1. *Reading, Repetition, and Penmanship.*—Ten minutes' daily practice in each.

2. *Teaching.*—Chaps. xi. and xii., *Scholarship School Management.*

3. *Geography.*—
   (1.) The remaining American possessions.
   (2.) Revise Central America and the West Indies.

4. *English.*—
   (1.) Analysis, and the terms employed; derivation of terms used in grammar.
   (2.) Twenty-five roots and meanings per week.
   (3.) Literature, second half of the nineteenth century.
   (4.) *Julius Cæsar*, Act V., Scenes 3 and 4.

5. *History.*—George IV. and William IV.

6. *Arithmetic.*—Square and cube roots, and their application.

7. *Algebra.*—Arithmetical progression.

8. *Euclid.*—Revise Book II., Props. 1–7, with ten deductions per week. (See those given under P.T. Course.)

9. *Elementary Science.*—Motions of the sun and moon, real and apparent; simple explanations of phases of moon, lunar and solar eclipses, and seasons.

10. *Languages.*—Work one examination paper per week on *Epaminondas* (PRACTICAL TEACHER edition). Four chapters from *Le Roi des Montagnes.*

11. *Drawing.*—A freehand copy each week.

12. *Music.*—Chap. xxxi., *School Music Teacher.*

13. *Domestic Economy.*—Household management, expenses, and investments.

## Notes on the Work for the Month.

### 1. GEOGRAPHY.

The chief points to make sure of in the geography of the West Indies are the productions, imports, exports, ports, and government.

*Productions.*—The average temperature being about 78°, the vegetable products are tropical or subtropical in their character. They embrace sugar, bananas, oranges, coffee, cocoa, cotton, pimento, nutmegs, indigo, tobacco, maize, guava, ginger, cocoa-nuts, aloes, castor-oil plant, pine-apple, pomegranate, lemons, limes, citrons, mango. Yams, sweet potatoes, and manioc grow freely. The chief timber trees are mahogany, cedar, lignum vitæ, ironwood. Indian corn and rice grow freely everywhere.

The prosperity of the West Indies depended, in the eighteenth and early part of the nineteenth century, on the sugar crop, and this, in its turn, upon the cheap labour of slaves. When slavery was abolished, in 1833, the emancipated slaves refused to work more than was absolutely necessary for a bare subsistence, and the prosperity of the traders rapidly declined. The enormous increase in the European manufacture of bounty-fed beet-sugar tended still further to decrease the output of cane-sugar. A long period of commercial depression followed, from which the islands are not yet free. Sugar as a staple product is played out, but there is no reason why there should not be an enormous export of fruits, for the cultivation of which the climate and soil are particularly well suited. The only things needed are careful cultivation and rapid transit. Recently attempts have been made to send bananas to England, but somehow the result has not been to materially lower the retail price.

The difficulty of obtaining cheap labour has been to some extent solved by the importation of Indian coolies—Hindus, that is, hired for a term of years, with a free passage out and home. In the majority of cases these labourers stay on at the end of their agreement, and a street in a West Indian town usually presents a kaleidoscopic scene of colour and nationality. Every type possible by intermarrying is seen, and the "colour" varies from pure white to pure black.

The islands suffer much from hurricanes, like that which in 1898 practically devastated St. Vincent, Barbadoes, St. Lucia, and Trinidad, or that which in 1899 wrecked the island of Montserrat. To meet the distress consequent on these terrible storms, relief funds were opened at the Mansion House, and a Parliamentary grant of £65,000 was made.

The following table gives the chief points to be memorised:—

1. JAMAICA.—Area, 4,000 square miles; population, 750,000; transit, 16 days.
   *Towns.*—Kingston, Port Poyal, Spanish Town.
   *Government.*—Governor, legislative council, elected assembly.

2. BAHAMAS.—Area, 5,700 square miles; population, 50,000; chief industry, sponge-gathering.
   *Town.*—Nassau; transit, 14 days.
   *Government.*—Governor, legislative council, representative assembly.

3. LEEWARD ISLANDS.—These contain five presidencies, each with a local legislature, federated to form one government.

| | | Sq. Miles. | Population. | Capital. |
|---|---|---|---|---|
| (1.) | Antigua | 108 | 36,000 | St. John. |
| | Barbuda | 75 | 580 | ... |
| (2.) | St. Christopher | 68 | 35,000 | Basseterre. |
| | Nevis | 50 | 14,000 | Charlestown. |
| | Anguilla | 35 | 5,000 | ... |
| (3.) | Dominica | 291 | 27,000 | Roseau. |
| (4.) | Montserrat | 47 | 12,000 | Plymouth. |
| (5.) | Virgin Islands | 58 | 5,000 | Roadtown. |
| 4. | The Windward Islands— | | | |
| (1.) | Grenada | 15 | 55,000 | St. George. |
| (2.) | St. Lucia | 233 | 50,000 | Castries, Soufrière. |
| (3.) | St. Vincent. | 140 | 41,000 | Kingston. |
| (These are under one government.) | | | | |
| 5. | Barbadoes | 166 | 200,000 | Bridgetown. |
| 6. | Trinidad | 1,750 | 260,000 | Port of Spain, Fernando, etc. |
| 7. | Tobago | 114 | 20,000 | Scarborough and Plymouth. |

2. History.

The chief points in these two reigns are the Catholic Emancipation Bill and the great Reform Bill. These must be very thoroughly prepared, not only with regard to the terms of each, but also with regard to the history which rendered them necessary. The abolition of slavery in 1833 is also a feature of the gradual humanising of legislation.

3. Arithmetic.

There is little to add to what is said in the text-book. Men should be prepared to show how the arithmetical process is based upon the algebraic. It should also be noticed that in many cases it is simpler to obtain the square root or cube root by factors than by the ordinary method.

In such cases as, "By what number must 63700 be multiplied to make a perfect square?" reduce the number to factors, which are $13 \times 7 \times 7 \times 5 \times 5 \times 2 \times 2$, or $7^2 \times 5^2 \times 2^2 \times 13$. Then it is evident that another factor of 13 is required. Similarly with such questions in cube root.

4. Algebra.

Students should be able to establish the formulæ used in arithmetical progression—namely,

$$s = \frac{n}{2}(a + l),$$

$$l = a + (n - 1)d,$$

$$s = \frac{n}{2}\{2a + (n - 1)d\}—$$

by clear reasoning. If these are understood, there is no difficulty in any of the problems.

*Test Questions.*

1. *Penmanship.*
Large Hand:—*Lord Chancellor.*
Small Hand:—*He prayeth best who loveth best*
*All things both great and small.*

2. Write an essay on "The Duke of York's Tour" *or* "Our Volunteer Forces."

3. Say what you can of the mineral productions of the United States.

4. Explain clearly what is meant by the term "Dominion of Canada," and give a brief outline of the history of Canada.

5. Scan the following lines, and give the proper name of each:—
(*a*) "There was a sound of revelry by night."
(*b*) "How sweet the moonlight sleeps upon this bank!"
(*c*) "Proud is Maisie in the wood."
(*d*) "Sore boded the heart of the isle king of what the end should be."
(*e*) "I climbed the dark brow of the mighty Helvellyn.
(*f*) "The falling out of faithful friends, renewing is of love."

6. Paraphrase and analyse the following, and parse words in italics:—

"*Even* by the rule of that philosophy
By which I did blame Cato for the death
Which he did give himself,—I know not *how*,
But I do find it cowardly and *vile*,
For fear *of* what might fall, *so to prevent*
The time of life: *arming myself* with patience
*To stay* the providence of some high powers
That govern us below."

7. Explain how we lost the American colonies, and how this directed our attention to other parts.

8. The frame of a circular mirror is $5\frac{1}{2}$ feet long and $3\frac{1}{2}$ feet broad. Find the radius of the mirror when its area is equal to that of the frame. ($\pi = 3\frac{1}{7}$.) Ans. $1\frac{3}{4}$ feet.

9. A rectangular sheet of paper is covered with penny postage stamps. If the sides were each 1 inch less, the length of the paper would be twice its breadth; but if the sides were each 10 inches more, the length would be $1\frac{1}{2}$ times the breadth. Find the cost of the stamps used. (Dimensions of stamps $\frac{3}{4}\frac{3}{4}$ inch by $\frac{1}{4}$ inch.) Ans. £1, 10s.

10. Find a value for $k$ such that

$$x^6 + 2x^5 + 3x^4 + 4x^3 + 3x^2 + 2x + k$$

may be a perfect square. Ans. 1.

11. ABC is an acute-angled triangle. AK is drawn perpendicular to BC, and D is the middle point of BC. Prove that the difference of the squares on AB and AC is equal to twice the rectangle contained by BC and DK.

12. How would you treat a case of measles?

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CORRESPONDENCE: RULES.

To ensure an answer in the next issue, queries must be sent by the 15th of each month.

Name and address of sender, with coupon of current number of The Practical Teacher (and *nom de plume* if desired), must be enclosed.

As a rule, all replies will appear in the Correspondence Column; but any one desiring an immediate reply may obtain it by enclosing a stamped addressed envelope.

All communications and queries with regard to the PUPIL TEACHERS' AND SCHOLARSHIP COURSE should be addressed to "Mr. A. T. Flux, The Bays, Belvedere, Kent."

Answers to Correspondents.

*Doubtful.*—See next month's course.

*A.S.Y.*—The reading of the book recommended should be enough. If you want further practice, get Longmans' *Advanced Unseens in French.*

*E.R.P.*—Apply to the Secretary, Board of Education, Whitehall, London, S.W. It is not yet issued.

*H.T.*—A very good essay, 40/50, but it should be divided into paragraphs, each dealing with one phase of the topic.

*Second Year.*—The rhythm of the line should guide you; the first syllable must be accented.

(*Other correspondents answered by post.*)

# OUR CERTIFICATE COURSE FOR 1902.

BY GEORGE COLLAR, B.A., B.SC.,
*Head-Master of the Stockwell Pupil Teachers' School.*

## TEST QUESTIONS ON LAST MONTH'S WORK.

Theory of Teaching.

1. What is meant by proceeding "from the simple to the complex"? Point out errors which may arise from want of a clear understanding of the phrase.

2. Show how the impression made on the mind by a sensation is influenced by previous mental experiences, and point out the importance of this fact in teaching.

3. Give a summary of Locke's remarks on rewards and punishments.

Arithmetic.

1. Prove that the value of a fraction is not altered by multiplying both the numerator and denominator by the same number, and show how this principle may be applied in the simplification of complex fractions.

2. State and prove the rule for dividing one fraction by another, and explain as to children the real nature of the operation.

English Literature.

1. Give a summary of the second Act of *Macbeth*, and quote passages from it illustrating the characters of Macbeth and Lady Macbeth.

2. Explain the following phrases:—*The mere lees; minions of their race; witchcraft celebrates pale Hecate's offerings; fatal vision; sleep that knits up the ravelled sleave of care; making the green one red.*

### Euclid.

Women.—1. Trace the changes that occur in the sum of the squares of the two segments of a line as the dividing point moves from the middle of the line to one extremity.

2. Prove Prop. 9 by means of Props. 4 and 5 only.

Men.—Construct a square such that its sides shall pass through the angular points of a given rectangle.

### Trigonometry.

1. Give the numerical value of the six chief functions of an angle of 60°.

2. Show that—

(*a*) $\sin^3 A - \cos^3 A = (\sin A - \cos A)(1 + \sin A \cos A)$.

(*b*) $\frac{\sec A}{\operatorname{cosec} A} + \frac{\operatorname{cosec} A}{\sec A} = \sec A \operatorname{cosec} A$.

### French.

1. Give six French nouns which vary their meaning with their gender.

2. Give the rules for the position and inflection of adjectives of colour.

3. Translate into English :—

"Je ne vous aime pas, d'abord, lorsque vous êtes
Comme dans le portrait de la Salle des Fêtes,
Avec le grand manteau, la Toison d'or au cou !
Mais comme ça, tenez, vous me plaisez beaucoup.
Avec le doux argent de tes cheveux, qui flotte,
Tes bons yeux, ton gilet, la longue redingote,
Tu n'as l'air que d'un simple aïeul, en vérité
—Par lequel on pourrait être gâté."

4. Translate into French :—

"Most of our children," said a Swiss statesman, "are born to poverty, but we take care that they shall not grow up in ignorance." We advocate education, not merely to make the man the better workman, but to make the workman the better man.

## SYLLABUS AND NOTES FOR OCTOBER.

### English Composition.

Write essays on the following :—

1. Description of a forest.
2. Examinations.
3. The Different Classes of Poetry.
4. The Study of Literature.

Study the structure of the sentence and paragraph from Meiklejohn's *Art of Writing English*, or other text-book on composition, and read a few chapters from some of the works of standard prose writers that you possess, for the sake of observing how their writing conforms to the rules set out.

### Theory of Teaching.

(*a*) Study the methods of teaching elementary science and object lessons, and the way of drawing up notes of lessons. (Collar and Crook, chaps. vi. and xiii.) Object lessons lend themselves particularly well to the study of the methods of drawing up notes of lessons, but there is a danger which the student must avoid. During their apprenticeship many pupil teachers draw up notes for no other lessons than object lessons; hence they find a difficulty in treating such lessons as history or reading. The plan of setting out the notes in two columns is generally a good one; it is a pity that the name "method" is so commonly applied to the second. "Method" means order of thought, and here it is used for "treatment." It would be much better to head the columns "Matter" and "Treatment." The relative fullness of the notes under these two headings must vary widely with the nature of the subject. In a simple object lesson, in which the purpose is principally to *train*, the amount of matter is generally small—everything depends upon the way in which it is treated—but in a lesson on history to senior scholars the object is to *inform*, and the chief space should be given to the information which the teacher desires to impart; the "treatment" of nearly the whole can be indicated by the one word "exposition." It is quite useless in such cases to talk of "eliciting" the facts from the children; in such cases the lecturing or expository method must be adopted, and the teacher will show his skill mainly by the logical way in which he analyses his subject-matter, and the lucid way in which he sets it before his class.

(*b*) *Psychology.*—Study carefully Dexter and Garlick, chaps. vi. and vii. The study of "observation" is best taken this month in connection with the study of object teaching, because the main purpose of an object lesson is to train the powers of observation. This depends largely upon the powers of perception and habits of attention. But acuteness of perception and intensity of attention are not the only qualities of a "good observer." The attention must be directed to the *things*, and not so much to their *names*. But keenness of perception may be so excessively developed as to become detrimental to good observation. One quality of a good observer is the power of discriminating between the essential and the non-essential, and of recognising the relative importance of the several features. Two children are set to observe a rose leaf: one observes the general form, and draws it; but the other is so impressed with the serrated edges, that he represents the leaf as a rectangle or oval with a notched margin. The former is the better observer. The teacher must not only set his class to observe, but must test his pupils' observations. In judging the result, it is important to bear in mind that other factors must enter into it. Thus, a verbal description of a thing observed depends not only on the pupil's observation, but also on his powers of expression and skill in composition; and a drawing of an object observed, although a good test of visual observation, depends largely on the trained hand: and "ear-tests" enable one to gauge the pupil's accuracy in observing sounds; but the reproduction of the sound, which is often required in connection with ear-tests, requires a certain amount of voice training. The most valuable lessons in training the observation are object lessons and elementary science lessons; and in these lessons the danger lies in allowing the children to pick up statements in the teacher's words, as a substitute for making observations of their own. Drawing and ear-tests have already been referred to as means of training the observation of forms and sounds, but as a matter of fact nearly every lesson may be utilised in this way, and indeed it is only by treating it as a matter of observation that spelling can be pleasantly and effectively taught.

(*c*) Locke's *Thoughts on Education*, Sections VI., VII.—The paragraph on behaviour and manners is full of thought. After all, Locke says, the great thing is to implant a good spirit in a child, and if that be present, it "will of itself teach those ways of expressing it which he observes most acceptable;" and, again, "if their minds are well disposed, and principled in inward civility, a great part of the roughness, which sticks to the outside for want of better teaching, time and observation will rub off as they grow up, if they are bred in good company." This naturally leads to the consideration of the effect of the company with which the child is surrounded. Make a summary of Locke's arguments in favour of educating a boy at home instead of sending him to a public school; but remember—(*a*) that this is not one of the most important points from a school teacher's point of view, and (*b*) that our public schools have improved since Locke's days. The remarks on the reverence due to boys, and on the ill effects of practising before children those things which you would not have them imitate, are worthy of very careful consideration, "for you must always remember that children affect to be men earlier than is thought." This consideration will help the teacher in dealing with such a practice as smoking, which boys carry on because they think it manly.

### Arithmetic.

Study the theory of decimals—*New Arithmetic*, chaps. xxii. and xxiii. Close attention must be paid to the intimate connection between integers and decimals, and in most cases it will be found that if the pupils have been taught to pay attention to the place value of the digits in operating with integers, there is absolutely nothing fresh to learn in the ordinary operations with decimals. In the past very little attention has been paid in schools to approximate calculations, and the methods have had to be acquired later on. The Board of Education, in the new schemes for training colleges, emphasises this important branch of the work, and we advise our readers to make themselves thoroughly familiar with these labour-saving methods.

The whole of the theory of recurring decimals as given in chap. xxiii. should be thoroughly mastered, and many examples worked.

### English Literature.

Prepare in detail the third Act of *Macbeth*.

Scene 1, line 5. *Root.* The metaphor is aptly applied, because the kings would spring from him as a tree springs from its roots. The word *race* (Lat. *radix*) contains the same idea, but is now commonly made to include descendants.

14. *All-thing*, an adverb = completely.

15. *Solemn.* The modern meaning, which seems to exclude all idea of cheerfulness from the term, hardly holds here. The word is derived from *soleo*, I am accustomed, and *annus*, a year; and it meant originally, "something which was accustomed to take place every year."

31. *Parricide* = the murder of a father. Macbeth seized the

opportunity given by the flight of Malcolm and Donalbain to England for safety to accuse them of causing the death of Duncan.

47. *To be thus is nothing; but to be safely thus.* Paraphrase—It is nothing to have attained this regal position, but it is something to occupy it in safety.

54. *Whose being*, whose existence or life.

64. *Filed* = defiled.

93. *Clept*, called: from A.S. *cleopian*, to call. The form of the past participle, *y-clept*, is often pedantically used.

94. *The valued file*, the list setting out the special values. *File*, a list, and also an instrument for keeping letters, etc., in order, is derived from Lat. *filum*, a thread.

122. *Who* = whom. It is a rather common error to use the nominative form instead of the objective at the beginning of a sentence, just as it is to use the objective for the nominative at the end of a sentence. The ear pardons these errors somewhat readily, because in most cases the nominative comes at the beginning and the objective at the end of the sentence.

131. *Always thought.* An absolute phrase = it being always clearly understood (that I must be kept free from suspicion).

140–1. *Flight.....to-night.* The student will notice how the rime makes the passage seem trivial. In fact, as Shakespeare approached the zenith of his greatness, he more and more discarded rimes, so that we can put it down as a general rule that Shakespeare's best plays contain the fewest rimes; and the change is so gradual that the date of a play may be relatively fixed by the number of rimes to be found in it.

Scene 2, line 13. *Scotched* = cut across. The tails of lizards and many other reptiles will grow again if cut or broken off, and this fact has given rise to the myth that if a snake or worm be cut in two the parts will join together again—that the snake "will close and be herself."

18. *Suffer.* This is an infinitive, governed by "let."

22. *Ecstasy*—literally, a "standing out of oneself." Generally it refers to being *beside oneself* (and therefore out of oneself) with delight.

27. *Gentle my lord* = my gentle lord. The adjective was often misplaced in such expressions: "Good my lord" (*Richard II.*).

34. *Vizards*, masks or screens.

42. *Shard-borne beetle*, the beetle flying with shelly wings. A shard, or sherd, is a broken piece of pottery, and the wing covers of the beetle are compared to fragments of earthenware. Beetles are insects which have a pair of hard wings, and a pair of membranous wings beneath: our readers are familiar with the arrangement in the case of that common beetle called the lady-bird.

46. *Seeling* = covering.

The last four lines of the scene show how weak the passage becomes under the influence of rime.

Scene 4, line 14. *'Tis better thee without than he within.* The last clause is ungrammatical; the meaning is: It (the blood of Banquo) is better on the outside of you than within him.

37. *Sweet remembrancer!* With this phrase Macbeth thanks his wife for reminding him of his duty of welcoming his guests.

40. *Roofed*, completed; just as the putting on of a roof completes the building of a house.

53–93. Notice carefully to whom each sentence is addressed.

76. *Gentle weal*, the commonwealth, which is now gentle as the result of the purging. "Gentle" is derived from Lat. *gens*, a family, and is applied to the conduct, etc., which should be shown by members of one family to one another.

97. *A thing of custom* = an accustomed or usual thing.

116. *I pray you, speak not.* Lady Macbeth fears that if the nobles enter into conversation with her husband, he may admit things which may convict him.

126. *Magot-pies.* The plain name given to the bird is pie (from Lat. *pica*), because it is coloured black and white. (Compare piebald.) *Maggot*, or *Mag*, is a corruption of the Fr. *Margot*, a pet name for Marguerite. The name Mag came to be associated with the pie in the same way as Robin with redbreasts, Tom with tits and cats, Jack with asses, and Jenny with wrens.

125. *Augures* = prophecies based upon observations of the flights of birds.

131. Macbeth means that he was bribing a servant in the house of every noble to act as a spy.

141. *Season*—that is, the seasoning which preserves from decay.

Scene 5, line 24. *Profound:* here used in its literal sense, poured forth.

32. *Security* (from *se*, apart; *cura*, care), freedom from care, absence of precaution. Compare, and see the exact meaning of—

> "Upon my *sécure* hour thy uncle stole."
> *Hamlet*, I. v. 61.

Scene 6, line 25. *Due of birth*, the kingdom; that which is due on account of his birth; his birthright.

27. *Pious Edward*—that is, Edward the Confessor. (See the historical introduction.)

38. *Exasperate.* The Latin participle is *exasperatus*. Milton was particularly fond of using past participles of this class without the *-d*.

43. *Clogs me*, impedes me, hinders my free course.

Read Stanley's *Life of Arnold*, chaps. v. and vi., including the letters.

## Geometry.

Women.—Finish Euclid, Book II. Props. 12 and 13 should be carefully compared one with the other, and with Prop. 47 in the first book. In modern geometry, we speak of that part of a line intercepted between the perpendiculars from the extremities of another line as the projection of the second line upon it. If we use this term, the enunciations of 12 and 13 can be greatly simplified; in any case, we advise our readers to study the *particular* enunciations of these two propositions before the general, and then to examine the general enunciations and try to find out whether it would be possible to find shorter expressions to denote the lines dealt with in the particular enunciations than are used in the general. The student will then come to the conclusion that, although the enunciations seem cumbersome, they are really the most concise possible under the circumstances.

Men.—Book V. deals with ratio and proportion; but as the various theorems can be proved more easily and neatly by arithmetic and algebra, the book is seldom studied, although the student who cares to go through it and carefully notice the exact meaning of the terms employed will no doubt find it interesting and profitable. Every student will do well to read through the definitions and the enunciations of the propositions, and note particularly Defs. 5, 10, and 12, and Props. 7, 9, 11, 12, 15, 16, 18, and 22, as these are required in the proofs of Book VI.

Prepare Book VI. to the end of Prop. 4.

## Trigonometry.

In dealing with the functions of two or more angles, we can divide our formulæ into two groups—(*a*) addition and subtraction formulæ, and (*b*) product formulæ.

The student should prepare from his text-book a geometrical proof of the four relations—

$$\sin(A + B) = \sin A \cos B + \cos A \sin B,$$
$$\cos(A + B) = \cos A \cos B - \sin A \sin B,$$
$$\sin(A - B) = \sin A \cos B - \cos A \sin B,$$
$$\cos(A - B) = \cos A \cos B + \sin A \sin B.$$

This is not difficult if none of the angles employed exceed 90°. The point to notice is the introduction of the same quantity as a multiple and submultiple, which alters the *form* of the expression, but does not alter its *value*. For the sake of practice, it is advisable to go through the geometrical proof in one or two cases in which the angles exceed one right angle.

These formulæ are sometimes difficult to remember, but it should be noticed that in the case of the sines the connecting signs are the same on both sides of the equation, while in the case of the cosines they are different.

From these formulæ we can determine the value of any function of the sum or difference of two angles in terms of the same function of the angles themselves.

$$\tan(A + B) = \frac{\sin(A + B)}{\cos(A + B)}$$
$$= \frac{\sin A \cos B + \cos A \sin B}{\cos A \cos B - \cos A \sin B}$$

(divide both numerator and denominator by cos A cos B)

$$= \frac{\dfrac{\sin A}{\cos A} + \dfrac{\sin B}{\cos B}}{1 - \dfrac{\sin A \sin B}{\cos A \cos B}}$$
$$= \frac{\tan A + \tan B}{1 - \tan A \tan B}.$$

Here, again, it will be noticed that as the numerator is derived from sin (A + B), the connecting sign is plus, while the connecting sign of the denominator is minus, as it is derived from cos (A + B).

In a similar way we may prove and remember that

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}.$$

The formulæ for the sine, cosine, and tangent of (A + B) and of (A − B) are so important that they must be committed to memory. The others need not be memorised, but should all be worked out for the sake of exercise; moreover, they should be worked out in two or three different ways, and the results compared. Thus—

(*a*) $$\cot (A + B) = \frac{\cos (A + B)}{\sin (A + B)} = \frac{\cos A \cos B - \sin A \sin B}{\sin A \cos B + \cos A \sin B}$$

(divide numerator and denominator by sin A sin B)

$$= \frac{\frac{\cos A \cos B}{\sin A \sin B} - 1}{\frac{\cos B}{\sin B} + \frac{\cos A}{\sin A}} = \frac{\cot A \cot B - 1}{\cot B + \cot A}.$$

(*b*) $$\cot (A + B) = \frac{1}{\tan (A + B)} = \frac{1 - \tan A \tan B}{\tan A + \tan B}$$

(divide numerator and denominator by tan A tan B, and this becomes)

$$= \frac{\frac{1}{\tan A \tan B} - 1}{\frac{1}{\tan B} + \frac{1}{\tan A}} = \frac{\cot A \cot B - 1}{\cot B + \cot A}.$$

The student should next notice the results to be obtained by adding and subtracting the four formulæ dealing with the sine and cosine of (A + B).

(i.) $\sin (A + B) + \sin (A - B) = 2 \sin A \cos B.$
(ii.) $\sin (A + B) - \sin (A - B) = 2 \cos A \sin B.$
(iii.) $\cos (A + B) + \cos (A - B) = 2 \cos A \cos B.$
(iv.) $\cos (A - B) - \cos (A + B) = 2 \sin A \sin B.$

Notice that in the last formula, in order to avoid negative quantities on the right-hand side of the equation, we subtract cos (A + B) from cos (A − B), not *vice versâ*. We obtain four results which are extremely important later on, if we take A + B = C and A − B = D, for then

$$A = \frac{C + D}{2} \text{ and } B = \frac{C - D}{2}.$$

The four resulting formulæ must be carefully remembered; they are—

(i.) $$\sin C + \sin D = 2 \sin \frac{C + D}{2} \cos \frac{C - D}{2}.$$

(ii.) $$\sin C - \sin D = 2 \cos \frac{C + D}{2} \sin \frac{C - D}{2}.$$

(iii.) $$\cos C + \cos D = 2 \cos \frac{C + D}{2} \cos \frac{C - D}{2}.$$

(iv.) $$\cos D - \cos C = 2 \sin \frac{C + D}{2} \sin \frac{C - D}{2}.$$

Work the examples at the end of the chapters.

### Political Economy.

Consider the question of rent. In treating this scientifically, we must carefully separate money paid for houses, etc., from the rent of land. It is the custom to speak of the regular payment for the use of many things as rent—for example, houses, pews, gas-meters, and gas-stoves; but the money paid in these cases is of the nature of interest on capital, and differs in some essential points from rent. Again, in dealing with rents, political science cannot take account of sentimental considerations which lead tenants to pay too high a rent rather than leave the home of their fathers, or which lead generous landlords to accept too low a rent occasionally from a tenant in distress.

*Ricardo's Theory of Rent.*—This theory was first enunciated by Dr. Anderson more than a hundred years ago, and again discussed by Malthus, in *The Nature and Progress of Rent*, in 1815; but Ricardo discussed it more fully in his *Principles of Political Economy*, 1817, and so the theory was named after him. In order to understand this theory fully, we must bear in mind that the productiveness of different plots of land is a very varying quantity, and not only does the absolute productiveness depend on the fertility and quality of the land, but its effective productiveness, as measured by the ease with which its produce can be brought to a market so as to be realised, also varies with its distance from towns, etc., and the available means of transport. Hence people who wish to make a profit out of the land compete in their endeavours to secure land which is (*a*) fertile, and (*b*) conveniently situated. And there will always be some land which, either from its barrenness or inconvenient situation, or both, will not yield sufficient produce to give a return of the cost of producing it, including both labour and a fair interest on the farmer's capital, and no one would think of cultivating it at a loss. Again, if the price of produce were to fall, some land which is now under cultivation would cease to be cultivated, because its cultivation would cease to give a return for the cost. Bearing this in mind, the student will see that there must be a point at which the cultivation of land *just* yields a sufficient return to cover the expenses of working it, and beyond that results in neither gain nor loss. This point is called the *margin of cultivation*. Evidently the cultivator of such land could pay no rent to the owner, or he would be out of pocket. The cultivator of land which in quality or position is superior to this can pay a rent to the owner of the land; in fact, he can pay as rent the whole amount by which his profits exceed those of a man cultivating land of the "marginal" quality. Hence we see that, as a result of the competition for land, the amount that can be asked for rent is the amount by which the value of its produce exceeds that of land on the margin of cultivation. For a farmer is just as well off whether he takes land which will just produce the cost of labour and the fair interest on his capital, or rents land which produces more than that, and gives the balance to the landlord. "The rent, therefore, which any land will yield is the excess of its produce beyond what would be returned to the same capital if employed on the worst land in cultivation" (*J. S. Mill*).

Although there are practically no farmers who pay no rent to the owners of the land, yet the whole rent is really paid for the profitable parts of their farms, although nominally paid at so much per acre on the whole. The rent of a farm generally includes the payment for the use of farm-buildings, and sometimes of stock; but this latter must be distinguished from the rent, because it is really the *interest on capital* invested, and this part of the rent of the farm varies in the same way as the rent of houses, etc., considered quite apart from land. On the other hand, if capital is sunk in the land by effecting drainage or other improvements which do not require periodical renewal, then the total income from the land thus artificially improved must be regarded as rent, just the same as if the quality of the land were wholly of natural origin.

Many cases will have to be considered in which Ricardo's theory of rent does not apply.

1. *The Métayer System.*—In this system the profit is shared between landlord and tenant in certain proportions which are immutably fixed by the custom of the country. In this the cultivator has a stimulus to increase the productiveness of the soil, but not to the same extent as if he were proprietor.

2. *The Ulster Tenant-right.*—This is a custom that gives the outgoing tenant a claim on the incoming one for unexhausted improvements. Mrs. Fawcett regards this payment as being really a part of the rent, and argues that the tenant would pay a higher rent if he had not to pay this sum on taking up the farm. But she seems to forget the other side of the picture; for if it is a part of the rent *paid* by the incoming tenant, it must also be regarded as a *rebate* on the rent which has been paid by the outgoing one. Its real effect is to debar the landlord from reaping the benefits accruing from improvements effected by the tenant, and thus it gives the tenant a feeling of security that in improving the farm he is working for his own advantage.

3. *Rack-rent.*—The rack-rent is the rent that land will produce as the result of open competition among those who desire to hold it.

4. *Cottier Tenancy.*—In this case the nominal rent is greatly in excess of the difference between the value of the produce of the land and of that on the margin of cultivation. Consequently the tenant could not pay it, and must always be in arrears. He has no stimulus to urge him to clear off his debts, for he could not if he tried, and at the same time he knows that the landlord cannot seize all that he has.

5. *Conacre Tenancy.*—In this case rent takes the form of work instead of money payment.

### French.

Finish the grammar of nouns and adjectives. Try in all cases to find out the reason for irregularity in the formation of the feminine: for example, in such words as *bénin, bénigne*, it is really the masculine that is irregular. In many cases, too, the spelling has to be modified to suit the sound, for the ear is more influential than the eye in matters of language: for example, *public* gives *publique*, not *publice; fi-er* gives *fi-è-re*, not *fi-e-re*, because the tonic accent must come on the last syllable but one when the last is mute.

Read carefully *Le Roi des Montagnes*, pp. 57–80, Practical Teacher edition, with retranslation of selected passages, and work Exercises 8–10.

# OUR QUERY COLUMN.

## RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the name and address of the correspondent, and the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

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*A.R.K.* (Chemistry).—The mixtures given for Honours, Part I., will not present much greater difficulty than those set for the Advanced Stage, except perhaps that somewhat difficult separations, such as a chloride from an iodide, may be given. It is the quantitative work that is of most importance, as the usual test is a qualitative determination of a mixture, followed by a quantitative analysis of the same substance.

*Paulinus.*—Dr. Green's *Handbook to Old Testament Hebrew*, containing elementary grammar, etc. (Religious Tract Society), or Gesenius' *Hebrew Grammar* (Oxford Press). A Hebrew and English Lexicon of the Old Testament is now being issued by the Oxford Press.

*School Museum.*—In reply to a query from Sr. M. Isabel, who wrote to ask if we could supply names and addresses of any firms willing to supply cases of specimens for a school museum, one of our contributors writes us as follows:—

"In the first place, I should recommend your correspondent to get Nelson's series of *Elementary Science in Object Lessons*. There are several footnotes giving valuable information concerning specimens.

"*Silk.*—Rickards of Bell Busk, Yorks, used to send out a case for either 2s. 6d. or 5s. But by far the most useful set of specimens may be got for a few pence, as recommended on page 136 of Nelson's *Elementary Science in Object Lessons*, Book II. I have thus got eggs, worms, moths, cocoons, chrysalis, and cocoon cut in two, showing chrysalis inside. A skein of finished silk, a reel of silk, and pieces of silk, satin, and ribbon, added to the others, make a set which is invaluable for lesson giving, and costing less than 1s.

"*Linen.*—A firm in Belfast (Robinsons, I think) used to send specimens. I would, however, recommend your correspondent to write to Moss, Rimmington, and Co., Selby, Yorks, and ask if they would send—(1) flax stems; (2) the same in various stages of manufacture; (3) a little ball of cord. These could be supplemented by pieces of linen material from the draper's. If they cannot get them, the name of a farmer can be given who, for sufficient to cover postage, would doubtless send specimens of flax stems.

"*Wool.*—Apply to Mr. Norman Grimshaw, The Poplars, Calverley, Yorks. On receipt of 2s., to cover cost of materials and postage, Mr. Grimshaw will send a very complete set of specimens, including—(1) wool in grease; (2) scoured wool; (3) dyed; (4) scribbled or carded wool; (5) condensed, showing the thick, loose threads into which it is first formed; (6) spun threads; (7) woven; also samples of mungo, shoddy, flock, moits and dirt—that is, hooked seeds, etc., extracted from among the wool fibres. Several correspondents who have received the foregoing specimens have written to say how well pleased they are with them. [An article giving a full description of the woollen manufacture appears in our August number.—ED.]

"*Soap and Carbolic Acid.*—Messrs. Calvert and Co., Manchester, send two good sets free.

"*Lead Pencils.*—See page 24, Nelson's *Elementary Science in Object Lessons*, Book III.

"*Matches.*—Bryant and May, London.

"*Safety Lamp, etc.*—The Hardy Patent Pick Company, Sheffield, send specimens of safety lamp, coal-mine diagrams, etc., for a small sum."

*Omega.*—Two thin lenses are in contact, and form an achromatic combination, one being equiconvex, and the other equiconcave. Calculate from the following data the radius of curvature of each surface of the concave lens, and the focal length of the combination:—

Convex lens. Radius of curvature, 10 cm.; refractive indices—for red, 1·480; for violet, 1·499.

Concave lens. Refractive indices—for red, 1·610; for violet, 1·667. (Science and Art Evening Exam., Light, 1897.)

Let $\mu_1$ and $\mu_2$ be the refractive indices of the convex lens for violet and red respectively. Then mean refractive index for convex lens $= \frac{\mu_2 + \mu_1}{2} = \frac{1{\cdot}480 + 1{\cdot}499}{2} = 1{\cdot}489$. Call this $\mu$. Then, if R and S be the radii of curvature of convex lens, and if $f$ be its focal length with respect to light for which the refractive index is $\mu$, we have—

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R} - \frac{1}{S}\right).$$

In the present case, R = − 10 cms., S = + 10 cms.

$$\frac{1}{f} = {\cdot}489\left(-\frac{2}{10}\right) = -{\cdot}0978.$$

Let $\mu'_1$ and $\mu'_2$ be the refractive indices of the concave lens for violet and red respectively. Then the mean refractive index for the concave lens $= \frac{\mu'_2 + \mu'_1}{2} = \frac{1{\cdot}610 + 1{\cdot}667}{2}$ $= 1{\cdot}638$. Call this $\mu'$. Also, let $f'$ be the focal length of concave lens for mean rays.

In order that the combination of the two lenses should be achromatic, we must have (see answer to *Perplexed*)—

$$\frac{\mu_1 - \mu_2}{\mu}\frac{1}{f} + \frac{\mu'_1 - \mu'_2}{\mu'}\frac{1}{f'} = 0,$$

$$\frac{{\cdot}019}{{\cdot}489} \times (-{\cdot}0978) + \frac{{\cdot}057}{{\cdot}638} \times \frac{1}{f'} = 0.$$

$$\therefore \frac{1}{f'} = +\frac{{\cdot}0978 \times {\cdot}019 \times {\cdot}638}{{\cdot}489 \times {\cdot}057} = {\cdot}0425.$$

Let F be the focal length of the combination. Then

$$\frac{1}{F} = \frac{1}{f} + \frac{1}{f'} = -{\cdot}0978 + {\cdot}0425$$

$$= -{\cdot}0553.$$

$$\therefore F = -\frac{1}{{\cdot}0553} = -18{\cdot}1 \text{ cms.}$$

To find the radii of the concave lens, notice that since the lens is equiconcave, R is positive, and S = − R. Then

$$\frac{1}{f'} = (\mu' - 1)\left(\frac{2}{R}\right).$$

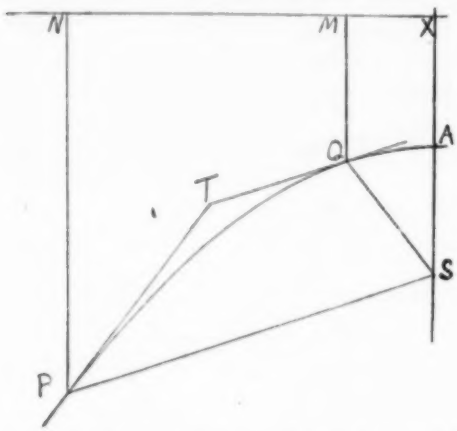
$$\therefore {\cdot}0425 = \frac{{\cdot}638 \times 2}{R} = \frac{1{\cdot}276}{R}.$$

$$\therefore R = \frac{1{\cdot}276}{{\cdot}0425} = 30 \text{ cms.}$$

Hence the radii of curvature of the equiconcave lens are equal to 30 cms. The focal length of the combination is equal to − 18·1 cms.

*Oriental.*—If PT, TQ are the tangents at two points, P, Q, on a parabolic trajectory, prove that the speed at P and the speed at Q are in the ratio of PT to TQ.

(Cambridge Local Senior, 1900.)




Let PQA represent the parabolic trajectory, S its focus, and XN its directrix. Draw PN, QM perpendiculars on the directrix.

Let $v$ denote the speed at P. Then, by a fundamental proposition in parabolic motion,

$$v^2 = 2g\text{PN}.$$

Similarly, if $v_1$ is the speed at Q,

$$v_1^2 = 2g\text{QM}.$$

$$\therefore v_1^2 : v^2 :: \text{QM} : \text{PN} :: \text{QS} : \text{PS}.$$

Again, by a well-known property of the parabola, SQT, STP are similar triangles,

$$\text{QT} : \text{TP} :: \text{QS} : \text{TS},$$

$$\text{and QT} : \text{TP} :: \text{TS} : \text{PS}.$$

$$\therefore \text{QT}^2 : \text{TP}^2 :: \text{QS} : \text{PS}.$$

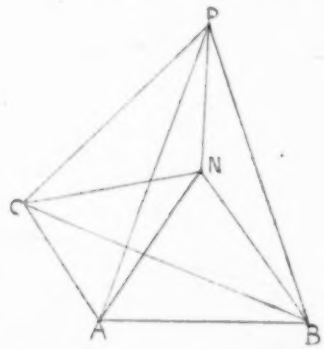
But we have shown that $\text{PS} : \text{QS} :: v^2 : v_1^2$.

$$\therefore v^2 : v_1^2 :: \text{PT}^2 : \text{TQ}^2.$$

$$\text{Hence } v : v_1 :: \text{PT} : \text{TQ}.$$

*Rogo.*—At each of three points in a horizontal plane the altitude of the top of a mountain is observed to be $a$. Find the height of the mountain above the horizontal plane in terms of $a$ and of the elements of the triangle formed by the three points.

(Oxford and Cambridge School Exam. Board.)




Let C, A, B be the three given points in the horizontal plane CAB, and P the top of the mountain. Draw PN perpendicular to the plane CAB, and meeting it in N. Join P and N with each of the points C, A, B.

Each of the angles PBN, PAN, PCN is equal to $a$.

$\therefore$ PN cotan $a$ = AN = BN = CN.

Hence N is the centre of the circle through C, A, B.

Denoting the radius AN by R, the perpendicular PN by $h$, the angle ACB by C, and the side AB by $c$, we have, from the well-known expression for the radius of the circumscribing circle of a triangle,

$$\text{R} = \frac{c}{2 \sin \text{C}};$$

$$\text{that is, } h \operatorname{cotan} a = \frac{c}{2 \sin \text{C}}.$$

$$\text{Hence } h = \frac{c \tan a}{2 \sin \text{C}}.$$

*Dalmellington.*—You are quite right—the correct answer is $6\frac{1}{11}$. The omission of the fraction $\frac{1}{11}$ in the fourth line of the solution doubtless accounts for the mistake.

*Don.*—We tender you our best thanks for solution to *C.N.* For want of space we are quite unable to insert it.

*Rex.*—For Final B.Sc.:—

1. Watson's *Advanced Physics* would form a good groundwork, but ought to be supplemented by the following—

*Sound.*—Poynting and Thomson (Griffin).

*Light.*—*Theory of Light* by Preston (Macmillan).

*Heat.*—*Theory of Heat* by Preston (Macmillan).

*Electricity.*—*Absolute Measurements in Electricity and Magnetism* by Gray (Macmillan).

2. For Practical Chemistry, Newth's *Chemical Analysis* would require to be supplemented by—

(1) *Qualitative Chemical Analysis* by Valentin (Churchill).

(2) *Practical Organic Chemistry* by Rideal (Lewis).

(3) *Quantitative Chemical Analysis*, Clowes and Coleman (Churchill).

(4) *Practical Methods of Organic Chemistry* by Gattermann (Macmillan).

3. Suitable books are—

(1) In addition to Edser's *Calculus* get *Differential Calculus* by Williamson (Longmans).

(2) *Integral Calculus* by Williamson (Longmans), or *Integral Calculus for Beginners* by Edwards (Macmillan).

*R. C. Hawkins.*—For Inter. B.Sc. (London):—

*Chemistry: Inorganic.*—Newth's *Inorganic Chemistry* (Longmans).

*Organic.*—Perkin and Kipping's *Organic Chemistry*, Vol. I. (Chambers).

*Practical.*—(*a*) Qualitative—Clowes' *Qualitative Analysis* (Churchill); or (*b*) Qualitative and Quantitative—*Practical Inorganic Chemistry for Advanced Students* by Chapman Jones (Macmillan).

*Algebra.*—Hamblin Smith's *Elementary Algebra* (Rivington), and Hall and Knight's *Higher Algebra* (Macmillan).

*Geometry.*—*Elements of Euclid*, Todhunter (Macmillan), or *Elements of Euclid*, Mackay (Chambers).

*Co-ordinate Geometry.*—*Right Line and Circle* by Briggs and Bryan (Univ. Tutorial Series).

*Trigonometry.*—*Elementary Trigonometry*, Hamblin Smith (Rivington), or *Elementary Plane Trigonometry*, Todhunter (Macmillan), and *Synopsis of Elementary Trigonometry* (Univ. Tutorial Series).

*Arithmetic.*—*Arithmetic for Schools*, C. Smith (Macmillan).

*Advanced Mechanics*, 2 vols. (Univ. Tutorial Series).

*Text-book of Physics* by W. Watson, B.Sc. (Longmans); or the following:—

*Sound.*—*Text-book of Sound* by Poynting and Thomson (Griffin).

*Light.*—*Advanced Light* by R. W. Stewart (Univ. Tutorial Series).

*Heat.*—*Heat for Advanced Students* by E. Edser (Macmillan).

*Magnetism and Electricity.*—*Advanced Magnetism and Electricity* by Poyser (Longmans), or *Elementary Electricity and Magnetism* by S. Thompson (Macmillan).

*General Physics.*—General Physics in Daniell's *Text-book of Physics* (Macmillan).

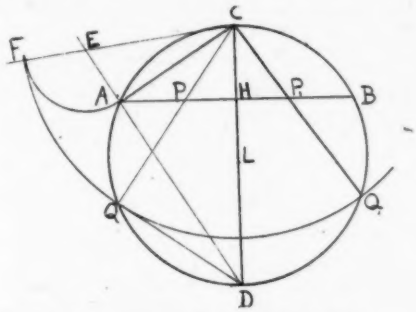
All the above text-books are also suitable for the Board of Education examinations in the respective subjects, with the exception that R. W. Stewart's *Light* does not deal with the wave theory of light, which forms about half the S. K. Syllabus in that subject. The wave theory may be worked up from Glazebrook's *Physical Optics*.

Roughly, the requirements of Inter. B.Sc. are equivalent to the second stage of the Board of Education examinations in inorganic chemistry, mechanics, and physics, the third stage in mathematics, and the first stage in organic chemistry.

Solutions to the following queries held over may be had by post upon application to the Editor: *Carlo, Salopia, Discipulus, Zeta, E. M. L., Felix, T. S. Knight, Brill.*

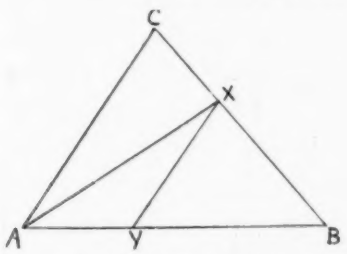
*T.A.S.; J.A.R.*—Please refer to Rule 2, Query Column.

*Vitax.*—AB is a chord at right angles to a diameter CD of a given circle, and AB is nearer to C than to D. Show how to draw through C a chord CQ, cutting AB in P, so that PQ may have a given length. (Science Exam., Hon. Subject V., 1900.)




Let DL (= 2X, suppose) be the given length.
Join CA, AD, and produce DA to E, making AE = X.
Join CE, and produce CE to F, making EF = X.
From C as centre, with radius CF, describe the circle $FQQ_1$, cutting the given circle in Q, $Q_1$.
Join CQ, $CQ_1$, cutting AB in P, $P_1$.
Then CQ or $CQ_1$ is the required chord, and PQ or $P_1Q_1$ shall be equal to 2X or DL.
Let H be the intersection of AB and CD. Join QD.
Then ∠ PHD is a right angle (hypothesis), and each of the angles CQD, CAD is right, these being angles in the semicircle CAQD.
Hence PQDH is a cyclic quadrilateral, and therefore QC . CP = DC . CH.
But DC . CH = DH . HC + $CH^2$ = $AH^2$ + $CH^2$ = $AC^2$.
And $AC^2 = CE^2 - AE^2 = CE^2 - EF^2 = (CE + EF).(CE - EF)$
= CF (CE − EF) = CQ (CE − EF).
∴ QC . CP = CQ (CE − EF).
And hence CP = CE − EF.
∴ CP + 2EF = CE + EF = CF = CQ = CP + PQ.
And hence PQ = 2EF = 2X = DL.

*H. E. M. Shepherd.*—Find a point X in the side BC of a triangle ABC such that if XY is drawn parallel to AC, cutting AB at Y, the triangle YBX is equal to the triangle AXC.
(Asst.-Surveyor of Taxes Exam.)




*Analysis.*—Suppose that X, the required point, has been found, and that XY has been drawn parallel to CA.
Join AX. Then, by hypothesis, the △ BXY is equal to the △ CXA.
Again, BXY, BCA are similar triangles, and BX, BC are homologous sides.
∴ $BX^2 : BC^2$ :: △ BXY : △ BCA (Euclid, VI. 19)
:: △ CXA : △ BCA.
But △ CXA : △ BCA :: CX : BC (Euclid, VI. 1).
∴ $BX^2 : BC^2$ :: CX : BC.
Hence $BX^2$ = BC . CX.
From this it follows that the required point X divides the line BC in extreme and mean ratio, and is therefore determined by Euclid, VI. 30.

*Alleyn.*—If $x_1y_1$, $x_2y_2$, $x_3y_3$ be the co-ordinates of three points not in one straight line, show that the co-ordinates of any other point can always be expressed in the form
$lx_1 + mx_2 + nx_3$, $ly_1 + my_2 + ny_3$,
where $l + m + n = 1$. (Cambridge Higher Local.)

Let $xy$ be any other point, and let the point of intersection of the line joining $x_1y_1$ and $xy$ with the line joining $x_2y_2$ and $x_3y_3$ be denoted by $x'y'$. We may represent the ratio of the segments into which $x'y'$ divides the line joining $x_2y_2$ and $x_3y_3$ by $m : n$, since, consistently with the relation $l + m + n = 1$, the ratio $m : n$ may have any finite value whatever.
Hence the co-ordinates of $x'y'$ are of the form

$$x' = \frac{mx_2 + nx_3}{m + n}, \quad y' = \frac{my_2 + ny_3}{m + n}.$$

Similarly, the ratio of the segments into which the point $xy$ divides the line joining $x_1y_1$ and $x'y'$ may be represented by $l : (m + n)$.

$$\text{Hence } x = \frac{lx_1 + (m + n)x'}{l + (m + n)} = \frac{lx_1 + (m + n)\dfrac{mx_2 + nx_3}{(m + n)}}{l + m + n}.$$

But $l + m + n = 1$. ∴ $x = lx_1 + mx_2 + nx_3$.
And, similarly, $y = ly_1 + my_2 + ny_3$.

*Perplexed.*—The mean refractive indices of two specimens of glass are 1·52 and 1·66 respectively. The differences in the indices for the same two lines of the spectrum are 0·013 for the first, and 0·022 for the second. Find the focal length of a lens of the second glass which, when combined with a convex lens of 50 cms. focal length of the first, will make an object glass achromatic for these two lines.
(*U.C.C. Text-book of Light*, p. 205, No. 18.)

The focal length $f$ of a lens, with respect to light for which the refractive index of the lens is $\mu$, is given by

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R} - \frac{1}{S}\right),$$

where R and S are the radii of curvature of the lens. The reciprocal of the focal length of the same lens, with respect to light for which the refractive index of the lens is $\mu_1$, will obviously be equal to

$$(\mu_1 - 1)\left(\frac{1}{R} - \frac{1}{S}\right) = \frac{\mu_1 - 1}{\mu - 1} \cdot \frac{1}{f}.$$

Let $\mu$ = mean refractive index for first lens (= 1·52).
$\mu_1$ = refractive index of first lens for the more refrangible line.
$\mu_2$ = refractive index of first lens for the less refrangible line.
Then $\mu_1 - \mu_2 = 0{\cdot}013$.
Let $\mu'$ = mean refractive index for second lens (= 1·66).
$\mu'_1$ = refractive index of second lens for more refrangible line.
$\mu'_2$ = refractive index of second lens for less refrangible line.
Then $\mu'_1 - \mu'_2 = 0{\cdot}022$.
Let $f$ = mean focal length of first (convex) lens (= − 50).
$f'$ = mean focal length of second lens (to be determined).
We now have the conditions—
1. The reciprocal of the focal length of a combination of two lenses placed in contact is equal to the sum of the reciprocals of the focal lengths of the lenses.
2. For a combination of two lenses to be achromatic, the focal length of the combination must be the same for the more refrangible as for the less refrangible spectral line.
We must therefore state analytically that the sum of the reciprocals of the focal lengths of the two lenses for the more refrangible line must be equal to the sum of the reciprocals of the focal lengths of the same lenses for the less refrangible line.

$$\frac{\mu_1 - 1}{\mu - 1} \cdot \frac{1}{f} + \frac{\mu'_1 - 1}{\mu' - 1} \cdot \frac{1}{f'} = \frac{\mu_2 - 1}{\mu - 1} \cdot \frac{1}{f} + \frac{\mu'_2 - 1}{\mu' - 1} \cdot \frac{1}{f'}.$$

$$\therefore \frac{1}{f'} \cdot \left(\frac{\mu'_1 - 1}{\mu' - 1} - \frac{\mu'_2 - 1}{\mu' - 1}\right) = \frac{1}{f}\left(\frac{\mu_2 - 1}{\mu - 1} - \frac{\mu_1 - 1}{\mu - 1}\right).$$

$$\therefore \frac{1}{f'} \cdot \frac{\mu'_1 - \mu'_2}{\mu' - 1} = -\frac{1}{f} \cdot \frac{\mu_1 - \mu_2}{\mu - 1}.$$

Substituting numerical values for the various constants, we get

$$\frac{1}{f'} \cdot \frac{0{\cdot}022}{0{\cdot}66} = \frac{1}{50} \cdot \frac{0{\cdot}013}{0{\cdot}52}.$$

$$\therefore f' = \frac{2{\cdot}2 \times 52}{66 \times 1{\cdot}3} \times 50$$

$$= \frac{1 \times 40}{30 \times 1} \times 50 = +\ 66{\cdot}67 \text{ cms.}$$

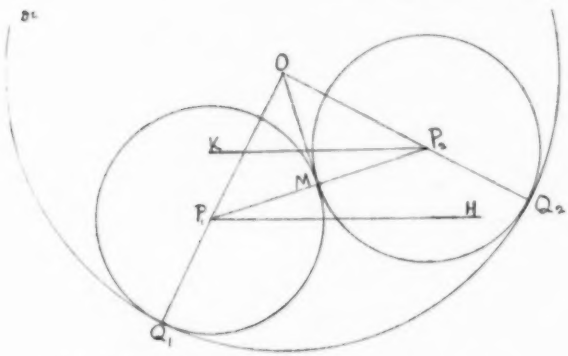
The positive sign affixed to the value of $f'$ indicates that the second lens must be divergent.

*W. H.*—Try Gregory's *Physical and Astronomical Geography* (London: T. Nelson and Sons).

*A. W. B.*—Two smooth spheres, having the same radius $b$, but different masses $m_1$, $m_2$, are lying in the bottom of a smooth spherical bowl of radius $a$. Prove that the line joining the centres of the spheres is inclined to the horizontal at an angle $\theta$ which is given by

$$\tan\theta = \frac{m_1 - m_2}{m_1 + m_2} \cdot \frac{b}{\sqrt{a(a-2b)}}.$$

(B.A., Royal University.)




Let O be the centre of the spherical bowl, $P_1$, $P_2$ the centres of the spheres, and $Q_1$, $Q_2$ their points of contact with the bowl. Let the spheres touch each other in M. Then M is in the line of centres $P_1P_2$. Join OM. All the points $Q_1$, $P_1$, O, M, $P_2$, $Q_2$ are in the same vertical plane. In the same plane draw the horizontals $P_1H$, $P_2K$. Then we have $\angle HP_1P_2 = \angle KP_2P_1 = \theta$, $OP_1 = OP_2 = a - b$, $\angle OP_1M = OP_2M = \alpha$ (say), and OM is perpendicular to $P_1P_2$.

Consider the equilibrium of the sphere whose centre is at $P_1$. This sphere is at rest under the action of three forces—

(1) Its weight $m_1g$ acting vertically downwards at $P_1$;

(2) The reaction $R_1$ of the bowl at $Q_1$ acting along the normal $Q_1O$; and

(3) The reaction R of the sphere at M acting along $P_2P_1$.

The sum of the moments of these forces about any point in their plane is zero. Take moments about O. The moment of $R_1$ about this point is zero.

Hence $R \cdot OM - m_1g \cdot OP_1 \cos OP_1H = 0$.

Similarly, for the other sphere, we have—

$$m_2g \cdot OP_2 \cos OP_2K - R \cdot OM = 0.$$

But $OP_2 = OP_1$.

Hence $m_1 \cos OP_1H = m_2 \cos OP_2K$.

That is, $m_1 \cos(\theta + \alpha) = m_2 \cos(\alpha - \theta)$.

$$\therefore \frac{m_1}{m_2} = \frac{\cos(\alpha - \theta)}{\cos(\alpha + \theta)}.$$

Hence
$$\frac{m_1 - m_2}{m_1 + m_2} = \frac{\cos(\alpha - \theta) - \cos(\alpha + \theta)}{\cos(\alpha - \theta) + \cos(\alpha + \theta)} = \frac{2\sin\alpha\sin\theta}{2\cos\alpha\cos\theta} = \tan\alpha\tan\theta.$$

$$\therefore \tan\theta = \frac{m_1 - m_2}{m_1 + m_2}\operatorname{cotan}\alpha.$$

$$\operatorname{cotan}\alpha = \frac{P_1M}{OM} = \frac{P_1M}{\sqrt{OP_1^2 - P_1M^2}}.$$

$$\therefore \operatorname{cotan}\alpha = \frac{b}{\sqrt{(a-b)^2 - b^2}} = \frac{b}{\sqrt{a(a-2b)}}.$$

$$\text{Hence } \tan\theta = \frac{m_1 - m_2}{m_1 + m_2} \cdot \frac{b}{\sqrt{a(a-2b)}}.$$

We regret that the space at our disposal in this column obliges us to strictly enforce the rule that each correspondent is restricted to one query.

*Hawkill.*—Find the $2p^{th}$ term and the sum of $2p$ terms of the series $2, -4, 8, -16, \ldots$ (C.H.E. Exam., 1901.)

This is a geometric series, the common ratio being $-2$.

Now the $n^{th}$ term of a geometric series whose first term is $a$, and whose common ratio is $r$, is given by the formula $ar^{n-1}$. In the given series $a = 2$, $r = -2$, and $n$ is to be $2p$.

Hence the $2p^{th}$ term is $2(-2)^{2p-1}$.

That is, $2\{2 \times (-1)\}^{2p-1}$;

or, $2^{2p} \cdot (-1)^{2p-1}$.

The value of $(-1)^{2p-1}$ is $(-1)$, for the index $2p - 1$ is odd. The value of the $2p^{th}$ term of the given series is therefore negative, and numerically equal to $2^{2p}$, and may be written $-(2^{2p})$.

Again, the sum of the first $n$ term of a geometric series is given by the formula $a\dfrac{r^n - 1}{r - 1}$.

Hence the sum of $2p$ terms of the given series is

$$2\frac{(-2)^{2p} - 1}{(-2) - 1}.$$

That is, $2\dfrac{1 - (-2)^{2p}}{3}$.

But $(-2)^{2p} = 2^{2p}$, since the index $2p$ is an even number.

The sum of $2p$ terms of the given series may therefore be expressed in the form $\frac{2}{3}(1 - 2^{2p})$.

Again, the sum of $2p$ terms of the series $2, -4, 8, -16\ldots$ is obviously equal to the sum of $p$ terms of the series $2, 8, 32\ldots$, together with the sum of $p$ terms of the series $-4, -16, -64\ldots$

That is, $2\dfrac{4^p - 1}{4 - 1}$ and $-4\dfrac{4^p - 1}{4 - 1}$.

That is, $-2\dfrac{4^p - 1}{3}$, or $\frac{2}{3}(1 - 2^{2p})$, as before.

We beg to draw your attention to the first of the rules at the head of this column.

*Allez.*—If $a + \sqrt{b}$ have a square root of the form $\sqrt{p} + \sqrt{q}$, where $p$ and $q$ are rational, show that $a^2 - b$ is a perfect square, and that it is the square of $p - q$. (S.K. Mathematics, Stage 2, 1901.)

$$\sqrt{(a + \sqrt{b})} = \sqrt{p} + \sqrt{q}.$$

Squaring both sides, we have

$$a + \sqrt{b} = p + q + 2\sqrt{pq}.$$

Then, by a theorem in surds, we must have

$$a = p + q, \text{ and } \sqrt{b} = 2\sqrt{pq}.$$

Hence
$$a - \sqrt{b} = p - 2\sqrt{pq} + q = (\sqrt{p} - \sqrt{q})^2.$$

But
$$a + \sqrt{b} = (\sqrt{p} + \sqrt{q})^2.$$

$$\therefore (a + \sqrt{b})(a - \sqrt{b}) = \{(\sqrt{p} + \sqrt{q})(\sqrt{p} - \sqrt{q})\}^2.$$

Hence $a^2 - b$ is a perfect square, and is equal to $(p - q)^2$.

*Rosalind.*—Find the logarithm with a positive maxima of $(\sin 26^\circ 35')^{-\frac{1}{4}}$. (S.K. Mathematics, Stage 2, 1897.)

$$\begin{aligned}\log(\sin 26^\circ 35')^{-\frac{1}{4}} &= -\tfrac{1}{4}\log\sin 26^\circ 35' \\ &= -\tfrac{1}{4}(\bar{1}\cdot 6507920) \\ &= -\tfrac{1}{4}(-0\cdot 3492980) \\ &= 0\cdot 0873245.\end{aligned}$$

The value you mention is not a possible answer.

*Thosmond.*—Show that if $a$, $b$, $c$ be unequal real quantities, the roots of the equation

$$\frac{1}{x + a} + \frac{1}{x + b} + \frac{1}{x + c} = 0$$

cannot be equal. (S.K. Mathematics, Stage 3, 1898.)

From the given equation we have

$$(x + b)(x + c) + (x + c)(x + a) + (x + a)(x + b) = 0.$$

$$\therefore 3x^2 + 2(a + b + c)x + bc + ca + ab = 0.$$

The roots of this quadratic equation are given by the formula

$$x = \frac{-(a + b + c) \pm \sqrt{\{(a + b + c)^2 - (bc + ca + ab)\}}}{3}.$$

Hence for equal roots we must have

$$a^2 + b^2 + c^2 + 2(ab + bc + ca) - (bc + ca + ab) = 0;$$

that is, $\frac{1}{2}\{(a + b)^2 + (b + c)^2 + (c + a)^2\}$ must $= 0$.

But this is impossible when $a$, $b$, $c$ are unequal real quantities, for then each of the squares $(a + b)^2$, $(b + c)^2$, $(c + a)^2$ must be a positive quantity which is not zero.

We beg to draw your attention to Rule 1 at the head of this column.

# ELIZABETHAN *V.* VICTORIAN ENGLISH.

BY GEORGE BEACH, M.A., LL.D., BARRISTER-AT-LAW.

THE following short and unelaborated article was drawn up as notes for the writer's English class studying *Julius Cæsar* with a view to the Scholarship Examination. Most of the examples are taken from that play, and many points not illustrated therein are of set purpose omitted. Elizabethan orthography has not been dealt with, because the spelling of the various authors is always modernised for the examination in question.

Very little credit can be taken for originality, and not much more for research.

## I. English was in an unsettled state.

1. *Almost any part of speech could be used as any other part.*
   (i) *Adjective for adverb*—"Good gentlemen, look *fresh* and merrily" (II. i. 223).
   (ii) *Adjective for noun*—"For this *present*" (I. ii. 163).
   (iii) *Noun for adjective*—"This last night here in *Philippi* fields" (V. v. 18).
   (iv) *Noun for verb*—"Why old men *fool* and children calculate" (I. iii. 65). *Path* (II. i. 83).
   (v) *Verb for noun*—"And sudden *push* gives them the overthrow" (V. ii. 5).
   (vi) *Conjunction for adverb*—
   (Cassius) "This rudeness is a sauce to his good wit.
   (Brutus) *And* so it is" (I. ii. 292).
   (vii) *Preposition for adverb*—"And *after* scandal them" (I. ii. 74).

2. *Many examples of apparent grammatical inaccuracy are met with.*
   (i) *Nominative for objective*—
   "I do beseech *ye*" (III. i. 158).
   "Save *I* alone" (III. ii. 60).
   (*N.B.*—*Ye* is the old nominative, and *you* the old objective.)
   (ii) *Objective for nominative*—"No mightier than thyself or *me*" (I. iii. 76).
   (iii) *Singular for plural*—"No *mean* of death" (III. i. 162).
   (iv) *Singular verb with plural subject*—"When grief, and blood ill-tempered, vexeth him" (IV. iii. 114).
   (v) *Plural verb with singular subject*—
   "Young Octavius with Mark Antony
   *Have* made themselves so strong" (IV. iii. 151).
   (vi) *Irregular sequence of tenses*—
   "But *do* not stain
   The even virtue of our enterprise,
   Nor the insuppressive mettle of our spirits,
   To think that or our cause or our performance
   *Did* need an oath" (II. i. 131–135).

3. *Old constructions retained then, but now obsolete.*
   (i) *Double negative*—"*Nor no* instrument" (III. i. 155).
   (ii) *Double superlative*—"This was the *most unkindest* cut *of all*" (III. ii. 180).
   (*N.B.*—This is really an example of a *treble superlative.*)
   (iii) *Past tense used as past participle*—"I have *took* them up" (II. i. 50).
   (iv) *Simple subjunctive*—
   "*Live* a thousand years,
   I shall not find myself so apt to die" (III. i. 159).
   (v) *Simple imperative*—"I do entreat you, not a man depart" (III. ii. 59).
   (vi) *Verb of motion omitted*—"Ay, every man away" (III. i. 120).
   (vii) *Impersonal construction*—"You were best" (III. iii. 12).

4. *Old inflections retained then, but now obsolete.*
   (*N.B.*—The great majority of these have been pruned away in modern editions.)
   (i) *Adverbial genitive*—"*Whiles* they behold a greater than themselves" (I. ii. 206).
   (ii) *His = its*—"My life is run *his* compass" (V. iii. 25).
   (iii) *Be = are*—"Such men as he *be* never at heart's ease" (I. ii. 205).

## II. The vocabulary was being experimented upon.

1. Such words as *conquest, custom, solace, feast, foible, host, pasture, succour, suffer, title* were introduced at this period, and came to stay.

2. Other words, like *deturpate, eluctate, formosity, lapidical, mulicrosity, multiloquy, sanguinolency, scelestick, splendidious, stultiloquy*, had a hostile reception, and were killed by neglect.*

## III. Clearness was preferred to grammatical correctness, and brevity preferred to both lucidity and accuracy.

This, of course, led to many elliptical expressions.
   (i) "So please him come unto this place" (III. i. 141).
   (ii) "For the repealing of my banished brother" (III. i. 51).
   (iii) "Vouchsafe 'good morrow' from a feeble tongue" (II. i. 313).
   (*N.B.*—Not to give, but to receive "good morrow.")
   (iv) "Give guess how near to day" (II. i. 3).
   (*N.B.*—How near it is to daylight.)
   (v) "What other bond
   Than secret Romans" (II. i. 124).

Abbott quotes from Ben Jonson's *Sejanus*—

"The prince that feeds great natures,
They will sway him."

## IV. Many Elizabethan words, especially prepositions, had many duties to perform which are now apportioned off to different words.

| Of = | By = |
|---|---|
| In (II. i. 156). | By means of (I. ii. 51). |
| By (III. i. 70). | Agent (I. ii. 186). |
| At (I. ii. 190). | As if by (II. i. 118). |
| Through or per (IV. iii. 201). | In the name of (II. i. 319). |
| About (I. ii. 58). | At (II. i. 78). |
| From (I. ii. 128). | Presently (II. i. 304). |
| Genitive (I. i. 49). | With (III. i. 236) (second). |
| Double genitive (I. ii. 123). | Close to (III. iii. 25). |
| Adjective phrase (I. i. 60). | |
| Adverbial phrase (I. ii. 30). | |
| Appositive (I. i. 70). | |
| Partitive (I. i. 63). | |

## V. The accent of many classical words was not settled.

The English rule is that in uncompounded two-syllabled nouns the accent is on the *first* syllable, as *in'come, ta'ble.*

On the other hand, many Latin derivatives retained their original accent on the *second* syllable, as *respect', contain'.*

In Shakespeare's dramas such words are found with varying accent. Thus *access, authorise, confessor, contract, contrary, commerce, instinct, obdurate, persevere, portents, relapse, sepulchre* are sometimes accented on the first and sometimes on the second syllable.

## VI. Certain suffixes, now monosyllabic (derived through French from Latin) were pronounced dissyllabically.

*Satisfac-ti-on* (II. ii. 74), *ambi-ti-ous* (III. ii. 77), *permis-si-on* (III. i. 248).

## VII. The language was spoken more rapidly.

This had considerable influence upon spelling and prosody. The "quantity" of a section of a foot had sometimes more influence than accent, and so long as a word was pronounced in such a way as to preserve the rhythm, the actual number of syllables mattered not so much.

"That made | them do it. | They are wise | and hon- | ourable" (III. ii. 218).

In contradistinction, words like *hour* and *fire* are often dissyllabic.

*N.B.—The references are to Moffatt's edition.*

* A German writer of a most immensely painstaking character, Dr. Weisse, gives the following statistics respecting the vocabularies of certain works or authors:—

PERCENTAGE OF WORDS.

| AUTHOR, ETC. | ELIZABETHAN, ETC. | | AUTHOR, ETC. | VICTORIAN, ETC. | |
|---|---|---|---|---|---|
| | Græco-Latin, including French. | Teutonic. | | Græco-Latin including French. | Teutonic. |
| Prayer Book. | 29 | 71 | Max Müller.. | 47 | 52 |
| Mulcaster... | 41 | 58 | Gladstone... | 48 | 52 |
| Spenser..... | 32 | 66 | Longfellow.. | 23 | 73 |
| Bible..... | 22 | 78 | Byron ..... | 23 | 76 |
| Shakespeare. | 33 | 62 | Tennyson... | 27 | 71 |

In Elizabethan literature, counting the particles, there is probably a greater percentage of Teutonic words than in Victorian literature; but if only words of inherent meaning be taken, and the particles omitted, then the latter is more Teutonic.

# OUR SCIENCE SECTION

☞ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.**

## THE SOUTH KENSINGTON SYLLABUSES FOR 1901.

AS already announced, the Board of Education has separated the Syllabuses from the general regulations of Science and Art with which they have for so long a time been connected, and we now have them in separate form under the title of Directory, Part II., the price of which is twopence.

**An Attempt at Order.**—In addition, there is an arrangement of related subjects in groups, the members of which should, it is presumable—albeit no intimation to that effect is to be found in the volume—be taken by the student as a desirable course in science. The groups are as follows:—

Group I. ENGINEERING, comprising Subjects I., Practical Plane and Solid Geometry; II., Machine Construction and Drawing; III., Building Construction; IV., Naval Architecture; VII., Applied Mechanics; XXII., Steam; and V*p*., Practical Mathematics.

Group II. PURE AND APPLIED MATHEMATICS, including Subjects V., Mathematics; VI., Theoretical Mechanics; XXII., Navigation; XXI. (*a*), Spherical Astronomy; and XXI. (*b*), Nautical Astronomy.

Group III. PHYSICS, including Subjects VIII., Sound, Light, and Heat; and IX., Magnetism and Electricity.

Group IV. CHEMISTRY AND METALLURGY, including Subjects X. and X*p*., Inorganic Chemistry, Theory and Practice; XI. and XI*p*., Organic Chemistry, Theory and Practice; XIX. and XIX*p*., Metallurgy, Theory and Practice.

Group V. GEOLOGY, MINING, AND PHYSIOGRAPHY, including Subjects XII., Geology; XIII., Mineralogy; XVIII., Mining; XXIII., Physiography.

Group VI. BIOLOGY, PHYSIOLOGY, AND HYGIENE, including Subjects XIV., Physiology; XV., Biology; XVI., Zoology; XVII., Botany; and XXV., Hygiene.

Group VII. Consisting of one subject only—namely, Subject XXIV., Agriculture.

**The Curricula.**—The Syllabuses in the following subjects are either totally unchanged, or have been but slightly modified by addition, omission, or recasting: II., IV., VII., V*b*., V., VI., XX., XXI. (*b*), VIII., IX., XI., XIX., XIX*p*., XII., XIII., XVIII., XXII., XXIII., XIV., XV., XVI., XVII., XXV., XXIV.

In Subject I., Practical Plane and Solid Geometry, there is a page of explanatory remarks preceding the Syllabus, which has been considerably elaborated and extended, recasting having been the fate of all the stages. The Honours Stage is divided into Parts I. and II.

Spherical Astronomy now precedes Nautical Astronomy as Subject XXI. (*a*), the former division now being known as XXI. (*b*).

In Advanced Light the "proof of the relation between the refractive index and the distances of an object and its image from (1) a plane, and (2) a spherical refracting surface," is to be studied. In Subject X., Theoretical Inorganic Chemistry, Advanced Stage, notable changes have been made.

In the first place, the following additions have been made to the already overburdened Syllabus: "The preparation, properties, and chief reactions of a few carbon compounds, chosen with the object of illustrating the processes of substitution, oxidation, and reduction; the meaning of constitutional formulæ, and evidence upon which they are constructed; also the characters of homologous series. The following compounds should be studied: marsh gas, ethylene, acetylene, ethyl alcohol, acetic acid, and their relations to one another." Furthermore, white lead and coal gas have been added to the list of bodies the manufacturing processes of which must be known. It is true that cadmium, gold, and one or two other metals have been withdrawn; but very little had to be learned in connection therewith, whereas the study of the carbon compounds and of the manufacture of coal gas will be a very considerable addition to the advanced students' already too heavy labour.

Another important new departure has to be noted in connection with this subject—namely, the division of the Syllabus into Sections I. and II., the latter consisting of the "manufacturing processes," the former of the rest of the Syllabus; and "four questions, out of a total of eight to be attempted, may be answered in subjects included in this Section" (Section II.). All candidates, however, will be required to satisfy the examiners in at least four questions taken from Section I. It may therefore be safely predicted that students of chemistry will have a busy time between now and next May. Perhaps the only word that may be said in favour of the change is that the Advanced Stage now completely covers the Intermediate Science Examination of London University.

There are one or two additions to the Advanced Stage of Organic Chemistry. For example, catechol and resoccinol are to be taken with quinol; the methods of distinguishing primary, secondary, and tertiary alcohols are to be known; and there is a new section in stereo-isomerism to the following effect: "Van t' Hoff's hypothesis and its application to a few prominent cases—for example, the lactic and tartaric acids, amyl alcohols, valeric acids, and benoses."

**The Future.**—Students of the following subjects are warned that the Syllabuses are under revision: Subject II., Machine Construction and Drawing; Subject XXIII., Physiography; Subject XXV., Hygiene; Subject XXIV., Agriculture. And whereas teachers and students of the first of these four subjects are plainly told that the revision is only to apply to the Session 1902–3, with respect to Physiography and Hygiene we have the bald announcement "under revision," so that it is more than probable that the Syllabus under which these two subjects are to be worked during the coming session has not yet been definitely fixed, a statement that is corroborated by the fact that a demand for these new Syllabuses at South Kensington was met by the reply that they were not yet ready, although all other Syllabuses are on sale.

## PHYSIOGRAPHY.

### (ADVANCED AND HONOURS.)

**The Auroræ.**—A close correspondence has been shown to exist between the seasons of greatest equatorial rainfall and the auroral displays, in agreement with the theory of De la Rive, who ascribes to equatorial evaporation the origin of the electricity to which the auroræ are primarily due. This connection was apparent from a study of Klein's published diagrams of the monthly condition of the aurora borealis. It was not possible to prove the connection in the case of the southern aurora, because of the non-existence of tables referring to the aurora australis corresponding to those Klein has prepared from his study of the northern phenomenon. This has now been remedied by the publication of Boller's diagrams of the aurora australis; and it is found that De la Rive's theory applies to both poles, and thus it is demonstrated that the brilliant streamers are of terrestrial origin, and are connected with other meteorological phenomena of our planet. Further, the Danish expedition under M. Paulsen has established the fact that there is an intimate agreement between the spectra of the auroræ and that of the light which surrounds the kathode of a tube containing a mixture of oxygen and nitrogen; hence the aurora must be regarded as an atmospheric phenomenon.

**Markings on Jupiter.**—Mr. Denning calls attention to some

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notable markings on the giant planet that were first observed by Dr. Kribbler of Stamford Hill. There is a large dark spot on the southern side of the south equatorial belt, nearly in the latitude of the red spot. This, on 24th July, was preceded by a number of small black dots 5° to 10° apart. The largest spot appears to be drifting westward. A conspicuous spot appeared in about the same latitude in the summer of 1889, when it formed the subject of an article by Mr. A. S. Williams.

**The Bolometer.**—"R.T.G.," in *Nature* for 8th August, in speaking of this very valuable instrument of research, says:—"Probably only those few who have used a bolometer can fully appreciate its difficulties. The principle of the research is quite simple. A spectrum is formed by suitable means, and allowed to fall on the bolometer—a very narrow strip of blackened platinum placed parallel to the lines of the spectrum. This strip forms one of the arms of a Wheatstone bridge, the other arm being a similar strip and two equal bridge coils. A screen is interposed between the spectrum and the bolometer, and the bridge adjusted until the galvanometer is undeflected. On removing the screen, the bolometer strip is heated by that part of the spectrum that falls on it. Its resistance is changed, and, assuming the battery current to remain constant, the deflection of the galvanometer spot is a measure of the change of resistance of the strip, and hence of the energy which it absorbs from the spectrum.

"The spectrum is then made to pass slowly across the strip. By noting the corresponding deflections of the galvanometer, a map can be drawn showing the distribution of energy in the spectrum. In a region of great energy the deflection is large, but as an absorption band crosses the strip it falls towards zero. When it is stated that a variation in the temperature of the strip of less than one-millionth of a degree affects the galvanometer appreciably, some of the difficulties become apparent. The very slightest changes in temperature of any part of the electrical system produce effects in the galvanometer which mask the effects it is sought to observe."

Our readers will not need to be told that the bolometer is the instrument used in the measurement of solar radiation.

**Mars.**—MM. Flammarion and Antoniadi have just published in the *Bulletin de la Société Astronomique de France* a very full account of their observations of Mars from October 23, 1900, to July 6, 1901. Tables are given showing the varying dimensions of the northern polar snow-cap, which at the summer solstice had a diameter of about 20 degrees. Fifty canali were noted, forty-six of which agree with the observations of Schiaparelli, and one with those of Cerulli. Only three cases of gemmation were noticed, of which the most prominent were Cerberus and Casius, which could easily be seen. The Styx was also thought to exhibit this phenomenon, but the separation was not sharp enough for a confident opinion to be formed as to its gemmation.

**Period of Mira Ceti.**—Professor Nijiland gives in the *Astronomische Nachrichten* the result of thirty-nine observations of this long-period variable. He finds that the minimum occurred last year on 3rd August, a fact that brings the variable back again to the short period of 1897, as will be seen from the following table:—

| Observed Maximum. | Predicted Maximum. | Magnitude. | Period. |
|---|---|---|---|
| Jan. 11, 1897 | Dec. 12, 1896 | 3·70 | ... |
| Nov. 26, 1897 | Nov. 9, 1897 | 3·24 | 319 days. |
| Oct. 4, 1898 | Oct. 6, 1898 | 2·91 | 312 days. |
| Sept. 19, 1899 | Sept. 3, 1899 | 3·75 | 350 days. |
| Aug. 3, 1900 | Aug. 1, 1900 | 3·35 | 318 days. |

**The August Meteors.**—Mr. W. F. Denning of Bristol, the great authority on meteorites, writes as follows on the August meteorites—namely, the Perseids and the Aquarids:—"On 10th, 11th, and 12th August a considerable number of meteors were recorded at various places where the clearness of the sky permitted observation. The maximum appears to have occurred rather later than usual, for the greatest number of meteors displayed themselves on Tuesday morning, 13th August; but the state of the sky did not allow the display to be fully observed during its rise, culmination, and fall. On 10th August the display was moderately rich." Between 9 hours 30 minutes and 15 hours the total number seen by Mr. Denning at Bristol was 102; and various other writers bear testimony to the fact that the display of Perseids for 1901 was decidedly above the average.

**Notanda for October.**—*Rainfall in October 1900.*—Rain fell on fourteen days, the total fall for the month being 1·54 inches, an amount below the average of the last fifty years by 1·27 inches.

**Mercury** is an evening star, near α Libræ about the 10th.

**Venus** is an evening star, near Antares on the 20th.

**Mars** is an evening star, setting very low down in the south-west after sunset.

**Jupiter** and **Saturn** are near together, low down in the south-west after sunset.

**Constellations.**—Cassiopeia, Andromeda, Pisces, and Cetus are in the meridian at midnight on the 1st; whilst Cancer and Orion are rising, and Hercules and Capricornus are setting. On the 27th inst. there is a partial eclipse of the moon, visible at Greenwich—the first contact with the shadow taking place at 2 hours 25 minutes p.m., the last contact being at 4 hours 6 minutes. As the moon does not rise at Greenwich until 4 hours 37 minutes p.m., only the last contact with the penumbra will be visible at that place at 5 hours 26 minutes p.m.

[B.A. (Lond.) writes us on the 7th September:—"I must let you know how highly I appreciate your paper The Practical Teacher, or rather that part of it which deals with examinations in science. The Physiography column has been of much real help, and is evidently compiled with great care and discretion. The last question of the Honours Physiography paper—the one which deals with recent research—was dealt with at length in the September number. I have now passed the Honours Examination in this subject—for which I believe a medal is given—and can recommend your paper as a good guide to others working up for the same. Have you noticed how easily the Honours, Part I., Geology, can be done by one who is taking Honours Physiography? If you were to call attention to this fine chance of killing two birds with one stone, I should say you would be doing a very serviceable thing to future students. A friend of mine passed in this examination under these conditions, and I did the same this year. The syllabus is almost entirely physiographical."]

### Books Recommended.

**Physiography and South Kensington.**—The courses recognised by the Board of Education are:—1. Section I. 2. Elementary. 3. Advanced. 4. Honours.

1. **Section I.**—Cartwright's "*Section One*" *Physiography*. (London: Thomas Nelson and Sons.)

2. **Elementary.**—Gregory's *Physiography* (revised edition), by Thomas Cartwright. (London: Thomas Nelson and Sons.)

3. **Advanced.**—*Advanced Physiography*, by R. A. Gregory. (London: Thomas Nelson and Sons.)

4. **Honours.**—The only book specially written for this course is *Honours Physiography*, by R. A. Gregory. (London: Thomas Nelson and Sons.) This work does not profess to do more than to deal suggestively with some of the more important questions coming under the purview of the Syllabus; but every Honours student should thoroughly master the whole of the book, and, in addition, acquaint himself thoroughly with one of the three branches of the subject—namely, astronomy, geology, or meteorology—especially keeping abreast with modern research by the careful study of *Nature*, *Knowledge*, the various geological and astronomical magazines, and Symons's *Meteorological Magazine*, taking due note, if possible, of foreign publications.

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**Iodine and the Colour of Iodine Solutions.**—Solutions of iodine may be divided into two classes—violet solutions, which transmit red and blue light, as does iodine vapour; and yellow or brown solutions, which transmit no blue light, but only red, yellow, and green. The solvents of the first class are carbon disulphide, hydrocarbons and their halogen derivatives, and other halogen-containing substances. Those of the second class are oxygen and nitrogen compounds, alcohols, aldehydes, ketones, ethers, and acids, provided they do not contain halogen. It is noteworthy that a solution in 83 per cent. sulphuric acid is violet, which, on solution to about 66 per cent., becomes reddish brown.

**Oxygen from the Air.**—M. Raoul Pictet, the Swiss chemist, who divides the honour of liquefying oxygen with M. Cailletet of Paris, has, according to a newspaper correspondent, invented a new process for obtaining oxygen from the atmosphere. The apparatus is divided into ten equal parts, separated from each other by a metallic plate, to which is attached a basin containing a certain amount of liquefied air. A spiral tube conducts the liquefied air to the basins. This exterior tube, called the interchanger, is continued, under the name of interior tube, within the apparatus, and winds round the metallic basin. When a slight pressure is applied to the liquefied gas by means of the

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interchanger, nitrogen of 90 per cent. purity is liberated. This action is continued in each of the ten divisions, until in the bottom one only pure oxygen remains, and is drawn off in a gas-holder. It is said that the cost of production is less than a tenth of a penny per cubic yard of oxygen.

**Barium Hydride.**—Herr Guntz describes this body, the formula for which is $BaH_2$, and the existence of which was first pointed out by Winkler. The compound is prepared by heating barium amalgam contained in an iron boat at 1,400° in a current of hydrogen. It forms a gray, crystalline mass, having a specific gravity 4·21 at 0°. Barium hydride melts at 1,200°, and at 1,400° in a current of hydrogen it slowly volatilises without decomposition, yielding a green vapour. It is decomposed by water, giving rise to barium hydroxide and hydrogen. When heated in nitrogen it evolves hydrogen, and becomes converted into the corresponding nitride $Ba_3N_2$, the latter compound being contaminated with a large amount of iron nitride $Fe_2N_2$, produced under these conditions by the interaction of nitrogen and the iron boat. These two nitrides are isomorphous, for the mixture is homogeneous and well crystallised. The amount of the iron compound produced increases with the temperature, and a similar phenomenon is observed when lithium nitride is prepared in an iron or nickel vessel.

**Oxides of Cobalt.**—Herr Hüttner, in publishing the results of his experiments and observations on the above, begins by reminding us that cobalt sulphate, when oxidised by means of (*a*) potassium persulphate in alkaline solution, (*b*) ammonium persulphate in acid solution, (*c*) ammonium persulphate in alkaline solution, or (*d*) chlorine gas, yields only the cobaltic oxide $Co_2O_3$. The state of hydration of the precipitated oxide depends on conditions which have not been ascertained, and the various products obtained were

$$Co_2O_3 . 2H_2O,\ 2Co_2O_3 . 3H_2O, \text{ and } 3Co_2O_3 . 5H_2O.$$

When oxidised by sodium hypochlorite, a product is obtained which contains more oxygen than $Co_2O_3$, and corresponds approximately with $Co_{19}O_{19}$. An alkaline solution of potassium cobalt sulphate, when oxidised with excess of iodine, gives a black precipitate of $CoO_2$. If less iodine is used, a less highly oxidised compound is obtained. The electrolysis of a solution containing cobalt sulphate and a large amount of potassium chloride yields the same oxide—namely, $Co_2O_3$—as oxidation by means of chlorine. It is therefore only by the direct application of hypochlorite that a higher state of oxidation than that represented by $Co_2O_3$ is reached. Cöhn and Salomon have suggested that a separation of cobalt and nickel may be carried out by electrolytically depositing cobalt superoxide at the anode. Herr Hüttner finds that on electrolysing a neutral solution of cobalt sulphate, a precipitate is formed at the anode, but is quickly redissolved (by the liberated acid). To prevent this re-solution, the whole mass was kept continually neutral by the gradual addition of sodium carbonate, and the precipitate so formed was found to be $Co_2O_3$. Cöhn's surmise of the production of the superoxide is, consequently, not confirmed.

**Absolute Zero.**—The hope of being able to liquefy helium, which would appear to have a boiling point of about 5° absolute, or only one-fourth that of liquid hydrogen, is dependent on subjecting helium to the same process as succeeds with hydrogen, only, instead of using liquid air under exhaustion as the primary cooling agent, liquid hydrogen under exhaustion must be employed, and the resulting liquid collected in vacuum vessels surrounded with liquid hydrogen.

**Some Figures.**—The following table embodies the results of experience and theory:—

| | Initial Temp. | Critical Temp. | Boiling Points. |
|---|---|---|---|
| Liquid helium ?..... | 5° ? | 2° ? | 1° ? |
| Solid hydrogen..... | 15° | 6° | 4° |
| Liquid hydrogen..... | 20° | 8° | 5° (He ?) |
| Exhausted liquid air... | 75° | 30° | 20° (H). |
| Air at 52° C. ..... | 325° | 130° | 86° (air). |
| Low red heat ..... | 760° | 304° | 195° ($CO_2$). |

**Explanation.**—The first column gives the initial temperature before continuous expansion through a regenerator, the second the critical point of the gas that can be liquefied under such conditions, and the third the boiling point of the resulting liquid. It will be seen that by the use of liquid or solid hydrogen as a cooling agent, we ought to be able to liquefy a body having a critical point of about 6° to 8° absolute. Then, if liquid helium could be produced with the probable boiling point of 5° absolute, this substance would not enable us to reach the zero of temperature; another gas must be found that is as much more volatile than helium as that body is than hydrogen, in order to reach within 1° of the zero of temperature. If the helium group comprises substances having the atomic weight 2, or half of that of helium, such a gas would bring us nearer the desired goal. In the meantime the production of liquid helium is a difficult and expensive enough problem to occupy the scientific world for many a day.

## SOUTH KENSINGTON EXAMINATIONS.

### Books Recommended.

1. **Elementary Alternative.**—Pilley's *Chemistry of Common Things* (Gill and Sons).

2. **Elementary Theory.**—Cartwright's *Elementary Practical Chemistry* (T. Nelson and Sons).

3. **Advanced Theory.**—Newth's *Inorganic Chemistry* (Longmans); or Roscoe's *Advanced Chemistry* (Macmillan and Co.); or Bailey's *Advanced Chemistry* (U.C.C. Press). Ramsay's *Modern Chemistry*, two small volumes (J. M. Dent), should also be consulted.

4. **Honours, Part I.: Theory.**—Newth's *Inorganic Chemistry*, as above (every word should be well known); Tilden's *Chemical Philosophy* (Longmans); Tilden's *History of Chemistry during the last Fifty Years* (Cassell and Co.); Perkin and Kipping's *Organic Chemistry*, Part I. (Messrs. Chambers); Ramsay's *Modern Chemistry*, Vols. I. and II. (J. M. Dent).

5. **Honours, Part II.: Theory.**—No book or books can be mentioned as covering this highly advanced and comprehensive course. The student should know Newth and the two parts of Perkin and Kipping thoroughly. He must also be well acquainted with the history of chemistry, especially in respect to the ionic theory as set forth by Van t' Hoff, Ostwald, and Arrhenius. The best book on historical chemistry is still Meyer's *History*, published by Macmillan; but it is on current chemical literature that the student must rely, such as the journal of the Chemical Society, *The Chemical News*, the journal of the American Chemical Society, and also the German and French periodicals. The standard is a very high one, and the student will be foolish to attempt the examination without a good knowledge of organic and inorganic chemistry in its many-sided modern developments.

6. **Elementary Practical.**—Cartwright's *Elementary Practical Chemistry*, as above.

7. **Advanced Practical.**—Clowes and Coleman's *Elementary Practical Chemistry* (Churchill), and *Elementary Quantitative Analysis*, by the same authors; or Newth's *Practical Chemistry, Quantitative and Qualitative* (Longmans).

8. **Honours, Part I.: Practical.**—Either Clowes and Coleman's two volumes or Newth's *Practical Chemistry*, as above.

9. **Honours, Part II.: Practical.**—Clowes's *Quantitative Analysis* (Churchill), and Gattermann's *Organic Chemical Preparations* (Macmillan and Co.).

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At the outset it may be necessary to point out to those of our readers who are concerned with or interested in the subject of Theoretical Mechanics, either for examinational or other purposes, that in the following "Notes" (chiefly intended for students in the advanced stages) a certain amount of familiarity with what may be called the simple elementary notions of the subject is assumed. This may be obtained from any suitable text-book, but far better in a laboratory, in which a student can "see," "try," and "measure." In this manner the elementary notions referred to are not confined to mere feats of memory, and the ability to obtain numerical results from given data is not dependent upon whether or not a similar question has been worked already.

It is proposed, as far as possible, to deal with the more important parts of the subject in the advanced stages of the two sections—"Solids" and "Fluids"—into which the subject is divided. In the attempt to give all the help we can in those portions which usually present difficulties to students, it is possible, owing to want of space, that some sections may not be dealt with as clearly as our readers may consider necessary, and others may be altogether omitted. To avoid this, the editor will be glad to receive any hints, suggestions, or queries which will tend to make these "Notes" of real use to those using them.

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VELOCITY.—*The velocity of a body is its rate of change of position.* The velocity is said to be uniform when the same time is always taken to move over the same distance, and variable when unequal spaces are described in equal times.

The space $s$, described in a time $t$, at a uniform velocity $v$, is given by $s = vt$. From this relation, when any two of the three quantities are known, the remaining one can be found. Thus, if $s$ and $t$ are known, then $v = \frac{s}{t}$.

When the velocity is variable, the velocity at any point can be obtained with a considerable degree of accuracy by finding the space moved through in a very small interval of time, say $\frac{1}{10}$th or $\frac{1}{100}$th of a second, and dividing the space so obtained by the time. In symbols, if $\delta t$ denote a small interval of time, and $\delta s$ the corresponding small space described, then velocity

$$= \frac{\delta s}{\delta t} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1).$$

The approximation to the actual velocity becomes closer and closer as $\delta t$ and $\delta s$ are made smaller and smaller, and finally, when they are indefinitely small, the velocity is $v = \frac{ds}{dt}$.

In the majority of text-books on mechanics the usual method of dealing with variable velocity is as follows:—"The velocity at any instant is measured by the distance which would be passed over in unit time if it continued to move during that unit of time with the velocity it has at the instant under consideration." This obviously assumes the very thing which had to be defined. Instead, the student should use the method indicated in Eq. (1).

ACCELERATION.—*The acceleration of a moving body denotes the rate of change of its velocity per unit time*, and may be either uniform or variable. Velocity and acceleration involving both magnitude and direction are called vector quantities, or, shortly, *vectors*. The manner in which the addition and subtraction of vectors may be effected will be referred to later.

A familiar case of uniform acceleration occurs in the motion of a body falling freely. In each second of its fall there is an increase in its velocity of $g$ feet per second, or 32·2 feet per second. Hence the acceleration is 32·2 feet per second per second. It will be noticed that the *time occurs twice*.

When this is clearly made out there will be no difficulty with such a statement as "the acceleration of a moving body is four miles per hour per second." This simply indicates that the velocity becomes four miles per hour greater each second. If at a given instant the velocity be, say, six miles per hour, then at the end of one second its velocity would be ten miles per hour, at the end of two seconds fourteen miles per hour, and so on.

Of *Newton's three Laws of Motion*, the second law, "change of motion is proportional to impressed force," is of paramount importance in dynamics. From it we obtain at once the fundamental relation connecting the acceleration $a$ produced in a body of mass $m$ by a force F. Change of motion is taken to indicate momentum; and the product of F and the time $t$, or the *time-action of the force*, is called *impulse*. Thus, if at a given instant the momentum of a body is $mv_1$, and, due to the action of a force F for a time $t$, the momentum becomes $mv$, then the force is measured by the change of momentum produced—that is,

$$Ft = m(v - v_1) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2).$$

If the time be one second—as the rate of change of velocity is acceleration—we obtain from (2) $F = ma$.

From the relation $F = ma$, given any two of the three quantities, we can obtain the remaining quantity.

*Books recommended*:—Advanced Stage: Fluids.—*Hydrostatics and Pneumatics* by Pinkerton (Blackie); *Elementary Hydrostatics* by Besant (Deighton, Bell, and Co.). Solids and Fluids.—*Statics* by Minchin (Clarendon Press); *The Student's Dynamics* by Minchin (George Bell and Sons); *Elementary Dynamics* by Loney (Cambridge University Press).

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*Elementary Lessons in Electricity and Magnetism*, by S. P. Thompson. (Macmillan and Co.) A well-known book, but subject to the same limitations as Poyser's work.

*Electricity: An Expansion of Everett's Deschanel, Part III.*, by J. D. Everett. (Blackie and Son.) An attractively got up book, containing mention of most important points known up to date. Many fairly advanced investigations are given, but the inclusion of worked-out examples in the more elementary parts would be an improvement. No questions (to speak of) are given. The U.C.C. *Electricity and Magnetism*, by Stewart, is a useful little book.

*Classified Questions in Electricity and Magnetism* (Elementary and Advanced, 1899–1900) can be obtained from A. T. Burgess, 16 King's Road, Peckham, S.E.

*Exercises in Electrical and Magnetic Measurements*, by R. E. Day (Longmans), is a useful book, dealing with numerical calculations.

Students should continually practise the solutions of numerical questions.

**Honours Stage, Part I.**—Professor J. J. Thomson's *Elements of Electricity and Magnetism*. A most useful book. The calculus is occasionally used.

Various special treatises on particular parts of the subject can be consulted with advantage.

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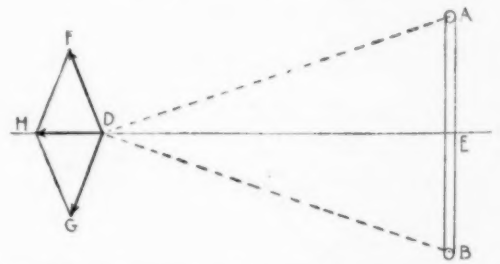
Notes on some of the more recent advances in the subject will be given from time to time in these columns. Students encountering serious difficulty should write to the Editor of the Query Column.

---

Judging from the questions set in the latest examinations in Magnetism and Electricity under the Board of Education, there is an ever-increasing tendency to require a certain amount of mathematical skill in students. A few of the questions exhibiting this tendency will here be solved, as a guide to those preparing for future examinations.

*Question.*—Find an expression for the magnetic force at any point on the axis of a circular coil carrying a steady current.

(*Magnetism and Electricity, Advanced*, 1901.)




Let AB be the section of a circular coil of one turn of wire, the radius EA of the coil being equal to $r$. Let it be required to determine the magnetic field, at a point D on the axis DE, at a distance $d$ = DE from the centre E of the coil, when the latter carries a steady current equal to C.

Let us suppose that the current flows downwards through the paper at A, and up through the paper at B, in traversing the coil of which AB is the section. Let us confine our attention for the moment to the magnetic field due to the current C flowing through a very short element of the coil at A. The lines of force due to this element of the current will be circles about A as centre; so that if we join DA, the magnetic field at D due to the current element will be perpendicular to DA. Since the

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current flows downwards at A, the direction of the field due to the current element in question will be from D to F. The magnitude of this field is equal to

$$\frac{Cl}{(DA)^2},$$

where $l$ is the length of the element of the circular coil. Let the vector (or directed line) DF represent the magnetic field due to the current element at A, both in magnitude and direction. Let us now turn our attention to the field at D, due to the current C flowing along an element of the coil, also of length $l$, at B. Since the current flows upwards through the paper at B, the field in question will be in the direction DG perpendicular to BD. Also, since BD is obviously equal to AD, the field due to the element at B can be represented in magnitude and direction by DG, which is equal in length to DF.

Complete the parallelogram DFHG. Then, since DF and DG represent component forces acting on a unit N pole, the resultant force on a unit N pole will be represented in magnitude and direction by the diagonal DH. Call this resultant R.

Since DF is perpendicular to AD, and FH is parallel to DG, which in its turn is perpendicular to BD, the angle DFH is equal to the angle ADB. Further, HF = GD = DF, so that the triangle HFD is isosceles. Also, the triangle ADB is isosceles. Hence the triangles HFD and ADB are similar. Consequently,

$$\frac{HD}{DF} = \frac{AB}{DA}.$$

But HD represents, in magnitude and direction, the resultant field R, due to the current C flowing along the two elements, each of length $l$, at A and B respectively.

$$\text{Also, } DF = \frac{Cl}{(DA)^2}, \text{ whilst } DA = \sqrt{(DE)^2 + (AE)^2}$$

$$= \sqrt{d^2 + r^2}, \text{ and } AB = 2r.$$

$$\therefore R = DF \times \frac{AB}{DA} = \frac{Cl}{(DA)^2} \times \frac{AB}{DA}$$

$$= \frac{2rCl}{(d^2 + r^2)^{\frac{3}{2}}} \quad \ldots\ldots\ldots\ldots \quad (1).$$

We may now suppose that the circular turn of wire is divided up into opposite pairs of elements, each element being of length $l$. Let there be $n$ pairs of elements, so that the total length of the turn of wire is equal to $2nl$. This will, in its turn, be equal to the circumference of a circle of radius $r$, or to $2\pi r$.

Each pair of elements will produce a magnetic field directed along the axis, of the value given in (1). Hence the $n$ pairs of elements will produce a magnetic field, also directed along the axis, of which the magnitude will be

$$n\frac{2rCl}{(d^2 + r^2)^{\frac{3}{2}}} = \frac{rC \times 2nl}{(d^2 + r^2)^{\frac{3}{2}}} = \frac{2\pi r^2 C}{(d^2 + r^2)^{\frac{3}{2}}}.$$

If, instead of one turn of wire, there are N turns, wound so closely together that the distances of the various turns from D may be taken as approximately equal, then the total field at D will be equal to

$$F = \frac{2\pi N r^2 C}{(d^2 + r^2)^{\frac{3}{2}}} \quad \ldots\ldots\ldots \quad (2),$$

and will be directed along the axis DH.

The above solution is not given as a model answer; the intelligent student can easily make many abbreviations, etc. It has been answered fully, since many little points which need not be given at length in answer to an examination question might nevertheless present difficulties to a student not very familiar with the application of mathematical reasoning to such problems.

To check the above working, put $d = 0$, when we shall find the magnetic field at the centre of the coil. This is seen to be equal to

$$\frac{2\pi N r^2 C}{r^3} = \frac{2\pi NC}{r},$$

a result with which the student is probably familiar in connection with the tangent galvanometer.

*Question.*—Find an expression for the magnetic force, due to a current flowing in a similar pair of co-axial circular coils of radius $r$, at a point on the axis at a distance $d$ from the plane of each coil.

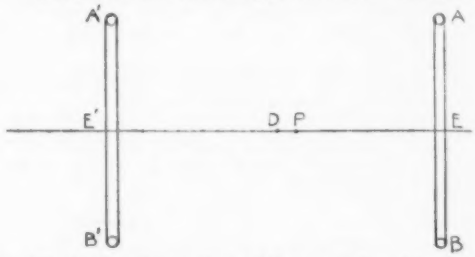
(*Magnetism and Electricity, Honours, Part I.*, 1901.)

The answer to this question is very easily deduced from the result found above. We have only to suppose that there is another coil co-axial with AB, at a distance $d$ to the left of D (Fig. 1). If the current flows round the two coils in a similar sense, the total magnetic field at D will be twice the value of the field due to one coil. Hence the total field will be equal to

$$\frac{4\pi N r^2 C}{(d^2 + r^2)^{\frac{3}{2}}}.$$

*Question.*—Find an expression for the magnetic field due to unit current in a pair of co-axial coils, of radius $r$, at a distance $2d$ apart, at a point on the axis of symmetry at a distance $x$ from the centre of symmetry, and deduce the value of $d$ for which the field near the centre is most uniform.

(*Magnetism and Electricity, Honours, Part II.*, 1901.)




Let AB, A′B′ be the sections of the two coils, with a common axis of symmetry E′E, the centre of symmetry of the whole being at D. Let it be required to find the magnetic field at the point P, where DP = $x$. Then PE = $d - x$, and PE′ = $d + x$.

By reasoning precisely similar to that used above, the field at P due to the current C, in the coil AB, will be found by substituting $(d - x)$ for $d$ in (2). The field at P due to the current C, in the coil A′B′, will be found by substituting $(d + x)$ for $d$ in (2). Hence the total field at P due to unit current (C = 1) in both coils will be equal to

$$F = 2\pi N r^2 \left\{ \frac{1}{\{(d+x)^2 + r^2\}^{\frac{3}{2}}} + \frac{1}{\{(d-x)^2 + r^2\}^{\frac{3}{2}}} \right\} \quad \ldots \quad (3).$$

If the field F near the centre of symmetry is uniform, we must have

$$\frac{dF}{dx} = 0,$$

when $x$ is small in comparison with $d$.

Differentiating (3) with respect to $x$, and equating the result to zero, we get

$$-2\pi N r^2 \left\{ \frac{3(d+x)}{\{(d+x)^2 + r^2\}^{\frac{5}{2}}} - \frac{3(d-x)}{\{(d-x)^2 + r^2\}^{\frac{5}{2}}} \right\} = 0.$$

$$\therefore (d+x)\{(d-x)^2 + r^2\}^{\frac{5}{2}} = (d-x)\{(d+x)^2 + r^2\}^{\frac{5}{2}} \quad \ldots \quad (4).$$

We must now take account of the fact that $x$ is small in comparison with $d$. In this case,

$$(d+x)^2 + r^2 = d^2 + r^2 + 2xd + x^2$$
$$= d^2 + r^2 + 2xd,$$

neglecting $x^2$, which will be small in comparison with the remaining terms. Also,

$$\{(d+x)^2 + r^2\}^{\frac{5}{2}} = (d^2 + r^2 + 2xd)^{\frac{5}{2}}$$

$$= (d^2 + r^2)^{\frac{5}{2}}\left(1 + \frac{2xd}{d^2 + r^2}\right)^{\frac{5}{2}} = (d^2 + r^2)^{\frac{5}{2}}\left(1 + \frac{5xd}{d^2 + r^2} + \ldots\right),$$

expanding by the binomial theorem, and neglecting terms comprising the second and higher powers of $x$.

$$\text{Similarly, } \{(d-x)^2 + r^2\}^{\frac{5}{2}} = (d^2 + r^2)^{\frac{5}{2}}\left(1 - \frac{5xd}{d^2 + r^2} \cdot \ldots\right).$$

Substituting in (4) above, and dividing through by the common factor $(d^2 + r^2)^{\frac{5}{2}}$, we get

$$(d+x)\left(1 - \frac{5xd}{d^2 + r^2}\right) = (d-x)\left(1 + \frac{5xd}{d^2 - r^2}\right).$$

Collecting terms in $d$, we get

$$\frac{10xd^2}{d^2 + r^2} = 2x. \quad \therefore 5d^2 = d^2 + r^2;$$

and, finally,

$$d^2 = \frac{r^2}{4}. \quad \therefore d = \frac{r}{2}.$$

Hence, in order that the field near the centre of symmetry of the two coils shall be as nearly uniform as possible, they must be placed at a distance $2d = r$ apart, or the distance apart of the coils must be equal to the mean radius of either of the equal coils.

This is the principle of the Helmholtz galvanometer. In the ordinary tangent galvanometer a small movement of the needle may bring the poles of the latter into positions where the field has considerably fallen off in strength. In the Helmholtz galvanometer two similar coils are placed co-axially at a distance apart equal to the mean radius of either. In this case the field is nearly uniform for some distance on either side of the centre of symmetry, so that if the needle is placed at that point, a considerable motion can occur without bringing its poles into a field sensibly different from that at the centre of symmetry.

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*Prize Editor*—W. T. THOMPSON, B.A. (LOND.), *French and German Honours.*

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WE should like to specially direct the attention of our readers to the fact that the Board of Education, in the Syllabuses for the Scholarship and Certificate Examinations 1901 and 1902, requires "no set books" for French and German. Students preparing for these examinations, as well as students for London Matriculation, could not do better than attempt month by month the pieces set for translation here. They are from the best authors, and of varied character. A competitor who does not gain a prize can derive considerable benefit from the exercise. A study of the successful competitor's translation, and of our remarks, will help him to see where he might have done better. If desired, his paper can be returned (fully corrected) by enclosing six stamps together with a stamped and addressed envelope.—ED.

## RULES.

1. All translations should be **posted not later than October 8**, and addressed:—*Prize Editor*, Office of THE PRACTICAL TEACHER, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.
3. Competitors should adopt a pseudonym, and send name and address written on a separate piece of paper.
4. No competitor may take the prize offered more than once in three months.

## FRENCH PRIZE COMPETITION.

Avancer peu à peu dans la connaissance d'un auteur est un plaisir éminemment profitable. Pour mon compte, j'ai pris l'habitude de lire lentement et m'en suis bien trouvé. Je n'ai jamais lu la plume à la main. Je me contente de souligner d'un coup de crayon les passages à retenir comme annotation, ou à admirer esthétiquement. La lecture finie, fût-ce au bout de plusieurs jours, je résume l'œuvre sur une fiche portant le nom de l'auteur; j'écris mon impression critique; j'indique les endroits à citer ou à étudier. Le procédé me paraît bon, et bien des gens n'en ont pas d'autres. L'essentiel est de ne pas s'interrompre. La sensation qu'on peut avoir d'une œuvre dépend de la continuité de la lecture. Je crois qu'il faut s'abstenir d'apprendre par cœur. On retomberait dans les inconvénients des extraits de morceaux ou d'expressions choisies. La lecture doit donner une impression totale, qui se transfuse en vous précisément parce qu'elle est totale. Ceci n'empêche pas, bien entendu, de prendre des notes. La façon de lire dépend du tempérament personnel. En tout cas, il est toujours nécessaire de relire. La "relecture" est la pierre de touche du talent. On n'a pas envie de relire les choses médiocres. Voulez-vous savoir si une œuvre est bonne? Reprenez-la au bout de quelques mois. Mauvaise, elle ne supporte pas la relecture. Excellente, elle offre une saveur nouvelle.

ANTOINE ALBALAT.

## RESULT OF THE SEPTEMBER COMPETITION.

### French.

The prize is awarded to "Rustica," the pseudonym of Miss Fannie Nicholls, 144 Princes Road, Penkhull, Stoke-on-Trent.

*First Class.*—Eicarg, Chemineau, Kerboga, Stella Vere, Agaznog, Cerberus, Ballon d'essai, C.E.M., Conor, Botanist, Clyde, Floreat Devonia, Ouard, Cimi, Hungary, A plain woman, Agéo, Carpe diem, Zoe, Encore une fois, La printanière, Penyghent, Trilby, Ruddigore, Shakspere, Loll, Andromache, Kettering, J.E.C., Colet, Erimus, Tomb, Edwin Spencer, Automobile, Douglas, Lebam, Margaret Louisa, Nancy, Freya.

*Second Class.*—Duncan S., Swanston, Œdipus, Maiden City, A.S., Ephesian, Clorinda, Irénée, Marguerite, Difficile, Chaos, Felix, Aurora Leigh, Ballin Tubber, Carolus, Siuoul, B.A.H., Débutante, Bull-dog, Rosalind, Elan, Cassius, Eleven years, Yvonne, Quatre Juillet, Violet, Morganwg, L'espérance, Portia, Spero, Pathfinder, Bellona, Alice, Focus, Gainsborough, St. Gudule, Scotia, Rifle-shot, St. Mark's, Silly Suffolk, Nil desperandum, Sylvia, Esca, Ylime.

### Report.

The holidays are, no doubt, responsible for the diminution in the number of competitors. There was not this month a large proportion of really good papers. The chief complaint I have to make is one I have frequently made before—that many candidates did not try first to realise the general drift of the passage, and then from that find out the relationship of each part of the argument to the whole, and its dependence thereon. The competitors who translated *les petites pratiques religieuses* as "the little experienced nuns" were of this class. Some candidates did not translate *tirés à deux chevaux* by a corresponding English metaphor. Hence I got such translations as, "The children, drawn by two horses, do not know to which to listen." Some of the translations of the last sentence show a lack of caution in dealing with classical roots. I had, for example, "A bicephalous society, and biceps are monsters;" "a bicephalopodous society, and bicephalopods are monsters;" "a bicephalalgic society, and the bicephalalgies are monsters." For unconscious humour, any one of these three would be hard to beat.

### French Prize Translation.

"Would you know, sir," he went on, in a calmer tone—"would you know what is the greatest misfortune of the times we live in? It is this: that men and women, no longer sharing the same religious beliefs, have ceased likewise to follow the same rules of conduct.

"How, then, will it be possible henceforth for parents to agree as to the education of their children? Even this would not matter if, in imitation of the Orientals—who are, I daresay, very sensible people—we were to keep our womenkind shut up under lock and key. Little devotional exercises may serve, like dolls, comfits, and guitar ditties, to relieve the tedium of women in captivity; and who would be so cruel as to cavil at their innocent amusements? But in this Europe of ours, where women have become a predominant influence in society, it is essential that they should believe what we believe, and love what we love. Till this comes to pass, how can they agree with us on any point whatever? They have not the same moral principles as we: theirs would land us back in the thirteenth century; ours are the product of the age we live in. Reason is *our* only guide, but they must have superstitions to rule their life and sanctify their virtues, and, above all, to extenuate their faults and whitewash their sins. Hence the disorder and confusion that everywhere reign supreme. Drawn in opposite directions, children are at a loss to know whom to listen to; their convictions can only be half-convictions, and the people we meet nowadays have only half-formed characters. In short, the society we live in is bicephalous, and a bicephalous creature is a monster."

RUSTICA.

## TO FOREIGN AND COLONIAL READERS.

*From time to time we have been requested by subscribers in India, the United States, and the Colonies to give them an opportunity of taking part in the French Prize Competition. The present limit of time allowed to competitors practically restricts the area of competition to the Mother Country and to Europe. In response to the repeated requests we have received, we have determined to try the experiment of setting a piece for translation, and extending the time during which translations may be received, so as to give subscribers in foreign countries, and in our more distant colonies, as Australia and New Zealand, the opportunity to compete. We have been frequently assured that if such an opportunity were given, many readers would avail themselves of it. The first piece for foreign and colonial readers will be set next month, when the full conditions of the competition will be published. If the number of competitors entering is sufficient to justify it, the Foreign and Colonial Competition will become a standing feature of* THE PRACTICAL TEACHER.—ED.

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**History of King Alfred the Great of England.** By Jacob Abbott. To the older generation this is the reappearance of a friend of their childhood, when books were not written quite so much down to a child's level as at present. It is, however, a timely addition to the present King Alfred literature, having been written without reference to this year's millenary. Indeed, it gives the date of Alfred's death as 900 *or* 901 A.D., and, further, it has the candour to discuss the great man's character so dispassionately as to quote from the Life of St. Neot a statement which, if trustworthy, goes to prove that even the best specimens of humanity do not reach perfection. But it affirms, nevertheless, that since the days of Alfred his virtues have been accepted as those we all wish to believe typical of our race.

No reviewer, of course, sets out with the intention of referring this year to those ancient overdone cakes so dear to the young; but with apologies to the reader, it must be told that in this book there are given as a note four versions of the old tale, culled from Latin and Saxon sources. Mr. Abbott moralises thus on the incident: "Millions within the last thousand years have heard the name of Alfred who have known no more of him than this story; and millions more, who never would have heard of him but for this story, have been led by it to study the whole history of his life; so that the unconscious cowherd's wife, in scolding the disguised monarch for forgetting her cakes, was perhaps doing more than he ever did himself for the wide extension of his future fame."

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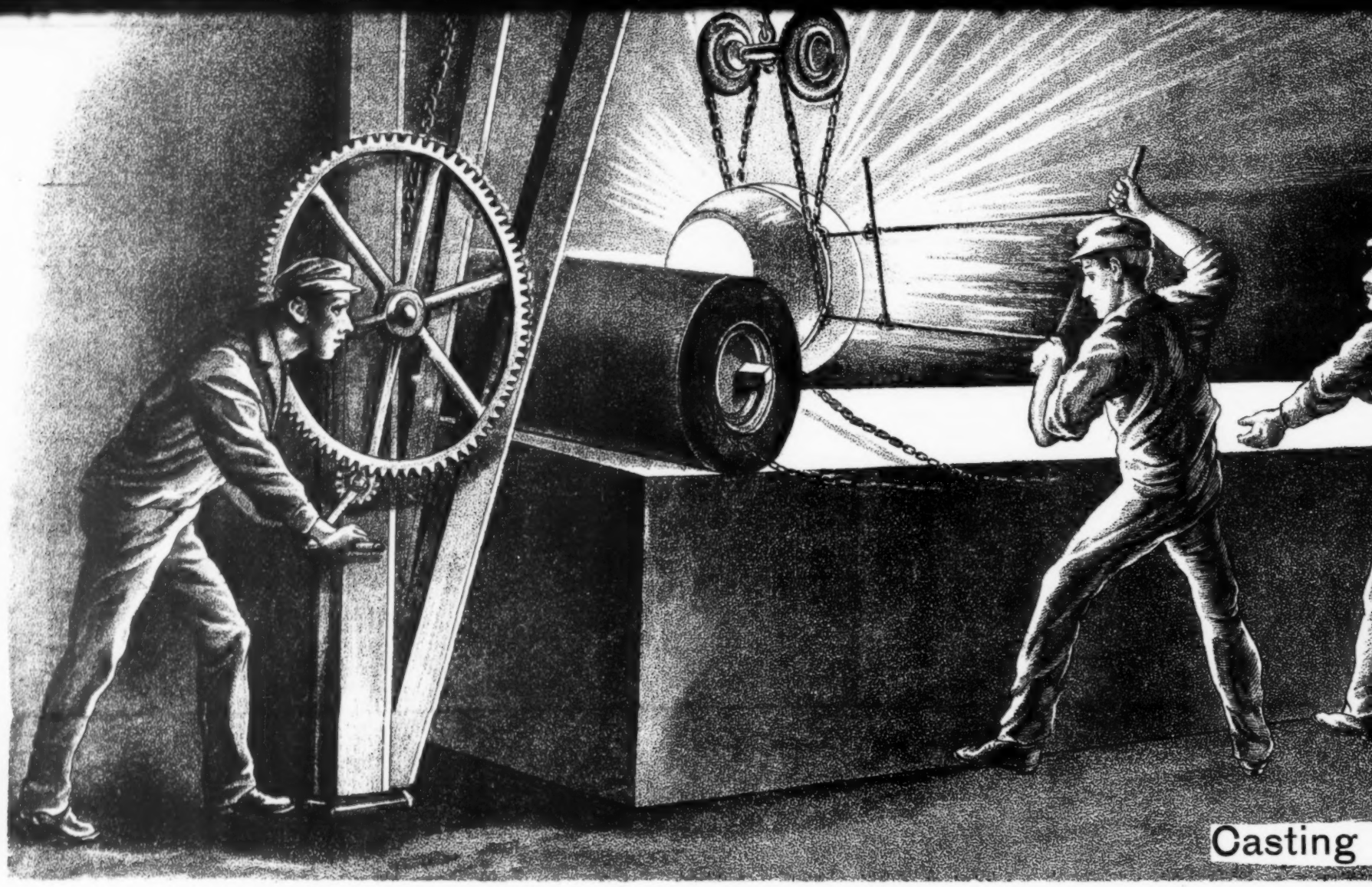

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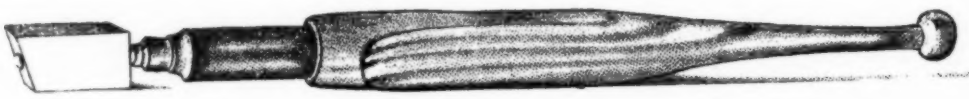

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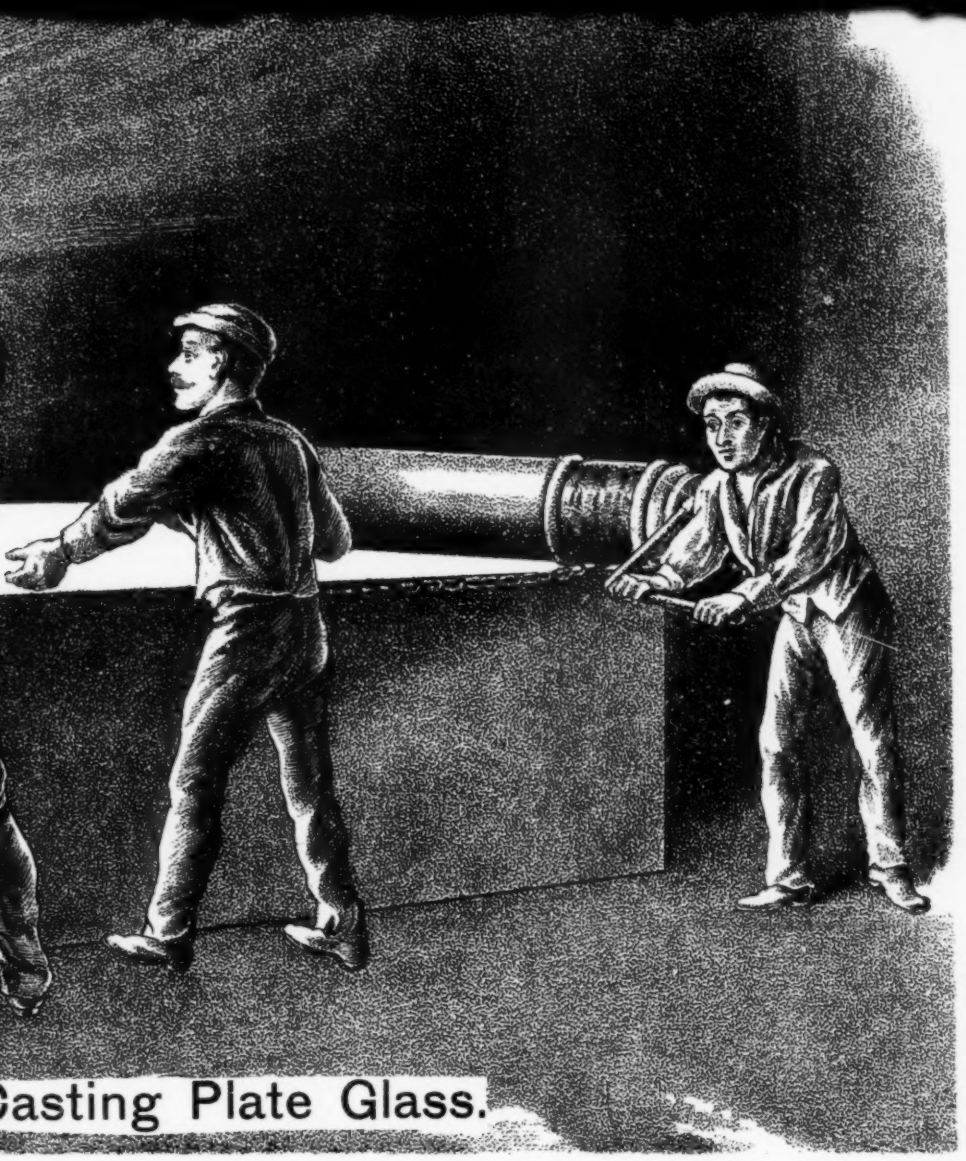

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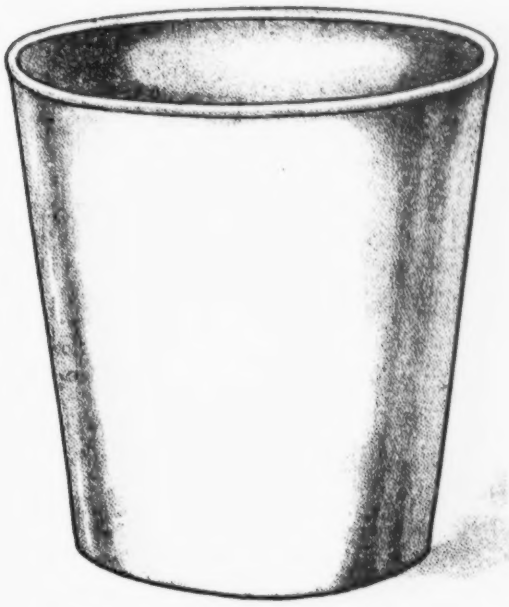

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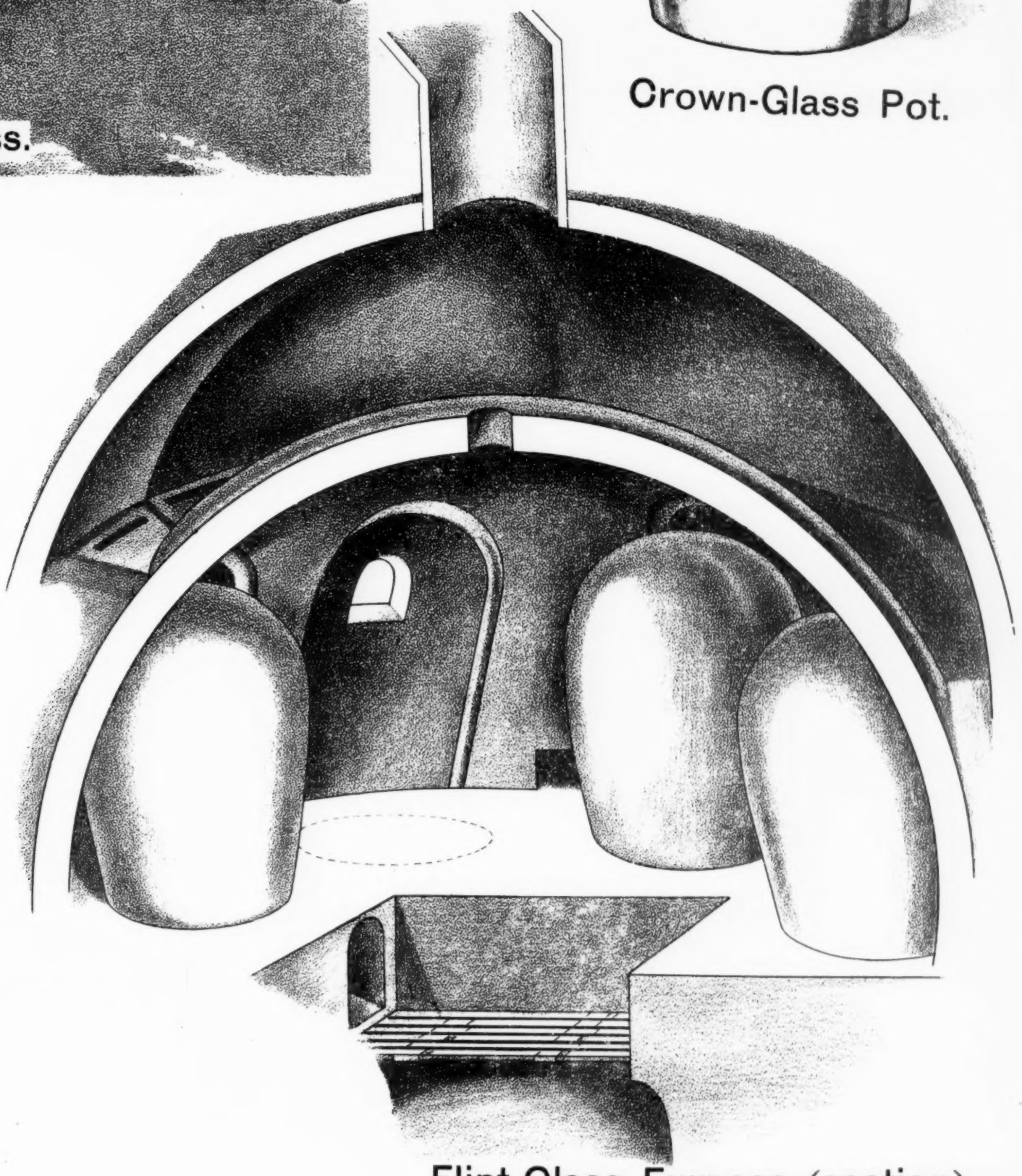

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